

# PSYCHOLOGY IN EDUCATION

BY

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## PREFACE

The major objective of the writer was to produce a volume that would contain and interpret the fundamental psychological facts, principles, and theories applying to education. Because the education of pupils is much more than the learning of subject matter, the contents of this text concerns itself with the fuller problem of pupil adjustment. Methods of effective learning demand the serious and devoted attention of the educational psychologist, but so also do the problems of growth, emotional reactions, behavior, and personality of pupils, capacity to learn, measuring and marking achievement, and the extent that pupils' abilities and characteristics can be and are determined by hereditary and environmental forces.

Considerable emphasis is placed on growth, development, and adjustment, as evidenced by the chapters and sections on physical growth, social growth, mental growth, and the emotional life and adjustment of the pupil. The interrelationship of these phases of growth are pointed out, and the educational importance of the increase with age in capacity to learn from natural growth is emphasized. Stress is laid on the emotional reactions and personal adjustment of the pupil so that the teacher in his effort to stimulate his pupils to learn subject matter will not overlook the pupil, with his feelings, emotions, and personal problems.

A prominent place is given to the problems of learning. Consequently several chapters are devoted to the capacity to learn, the principles of learning, factors influencing learning, how to study effectively, transfer of training, and methods of teaching. In this connection, the measuring and marking of pupils' learning and achievement are also discussed.

On the topic of nature and nurture, the author takes a divided point of view. In some respects, he is a rank hereditarian, believing, for example, that extremes in capacity, particularly the highest, are determined almost entirely by heredity. On the other hand, he believes that people's attitudes, points of view, and beliefs are acquired. The capacity for learning academic

material is probably fixed within fairly narrow limits by nature, but the health of children, especially in infancy, depends for the great majority on the care that they receive. All in all, the evidence indicates that both nature and nurture are extremely important and that we should make the most of each.

This book is not written as representative of any school of psychology. Not being a doctrinaire, the author has tried to utilize the experimental work from the sources applicable to the problem of education. No psychologist of any school is entirely wrong or entirely right. It probably is best in an elementary textbook to keep free from controversy and avoid extremes, making use of all psychology that will contribute to the improvement of the educational process.

An attempt has been made in discussing the problems to orient the pupil as completely as possible and to bring out many implications from the discussion. The author is opposed to narrow, arbitrary teachers whose methods are formal and consist largely of questions and answers, drill and review; on the other hand, he favors education that takes into account both child and subject matter, in which teaching methods are varied, where meaning is developed, and where the pupils live in a greatly enriched environment.

The author takes pleasure in acknowledging his indebtedness to a number of persons. First of all, it should be said that the greatest indebtedness is almost always to those workers who have reported their experimentation in their books and in the professional magazines. May he thank, especially, however, his present colleague Dr. Charles Saltus for reading the manuscript critically. May he also express his appreciation to a former teacher, Professor W. S. Miller, for whom he was office boy in his days as a graduate student; the author hopes that this book will show at least a little fruit from his indoctrination. He will surely recognize some of his very statements and experiences. The author is happy to acknowledge here also the extensive help that he received from his wife, who assisted materially by reading the manuscript and caring for innumerable details.

HERBERT SORENSON.

DULUTH, MINN.,  
May, 1940.



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## EDITOR'S INTRODUCTION

Modern educational psychology is a revolutionary force, albeit without doubt happily unconscious of its subversive role. In its beginnings it was a relatively respectable offshoot of such branches of general psychology as were represented by the psychophysics of Gustav Theodor Fechner, the sense physiology of Hermann von Helmholtz, the laboratory experimentalism of Wilhelm Wundt, the quantitative observations of Francis Galton and J. McKeen Cattell, the mental measurements of Alfred Binet, Lewis M. Terman, and Edward L. Thorndike, and the theories of William James and John Dewey. With modest scientific intent it sought only to study the process of learning, but to do this job scientifically and well, according to the tenets of the new experimental psychology, the educational psychologists found themselves trying to isolate and measure a multitude of factors affecting the quality and extent of learning.

Thus the students of educational psychology discovered the learner himself. They had to chart the progress of his growth and development. They had to study him to find out all the ways in which he was different from his fellows. They had to track down all the items which caused him to learn poorly or effectively. Was he fatigued? What were his physical, his social, surroundings? Was he conscious of success or failure? How did his interests, aptitudes, and needs condition his learning? What characteristics made him able to change his ways with great speed and effect? What tendencies caused him to resist being different from what he was at any moment?

The education which the new psychology was designed to serve was a relatively static thing. It had used certain subject-matter tools for so long a time that it had forgotten their original purposes and had settled down in academic security to manipulate them for their own sweet sakes. Into this atmosphere of instrument worship, the scientific study of learning burst with upsetting effect. Modern education is now just beginning to feel the impact. Henceforth, at an accelerating speed, it seems

destined more and more to recognize that education was made for learners, that learners cannot be studied with a mere combination of pious hope and a glance of the eye, and that subject matter of whatever category is properly only a means to learning and never a sacred end in itself.

In the professional preparation of teachers, educational psychology must become to a greater extent than at present an instrument for understanding learners if it does not wish to be trampled and left behind in the movement it helped to start. It must be integrated with the whole task of teaching. It must be applied and used from the first by the teacher who would make it an effective means of stimulating and directing the process of learning.

The present book is designed to assist this phase of teacher education. It gives the story of psychology's service to education, it summarizes the useful evidence which is now available for the purpose of understanding and helping learners, and it recognizes frankly the great gaps in psychological findings which education needs to have filled.

The author of this book is eminently qualified to perform such a service. His long experience as a teacher of educational psychology, his researches in the field, his work in administering a program of teacher education, and his clear recognition of the great scope of modern education combine to fit him conspicuously for the task of telling how psychology can serve educational purposes.

HAROLD BENJAMIN.

UNIVERSITY OF MARYLAND,  
May, 1940.

# PSYCHOLOGY IN EDUCATION

## CHAPTER I

### INTRODUCTION

Both scientific psychology and scientific education are relatively new, being hardly older than this century. Even though all sciences, both social and natural, have experienced tremendous increments of growth and development during the past few decades, probably none has shown so much as psychology and education. Furthermore, it is probable that potential growth in these two related fields is greater than that for most other fields of learning, and consequently we may expect many changes and improvements in the future for both.

Should the reader examine carefully the books in either psychology or education that were written at the turn of the century, he will note that most of them, if not all, are very different from those written now several decades later. Today, the books on psychology and education are changing rapidly. Research and experimentation have been going on at a tremendous rate for the last thirty years, and there is no evidence of a letup.

Forty years ago, a student in psychology or education could have found in relatively few books almost all that was written on a topic in which he was interested. In some instances, he probably could have carried them from the library to his room in one trip without much strain on his muscles. Today if a student wishes to consult all the references in education and psychology on a given topic, he must consult hundreds of periodicals and books. All this illustrates the fact that there has been a great increase in knowledge the past few decades.

Comparatively little experimentation and actual research in education and psychology were conducted forty to fifty years ago. Significant work was under way at that time, but as experimental sciences these two were in their infancy; and even today, it is doubtful that they have reached even their adolescence.

The student therefore should realize that the material in this book even if based on the best experimental evidence and even if sound and logical today will, in not the very distant future, be supplanted by results of more refined experimentation. Probably evidence that now seems true will be proved untrue; new areas now unexplored will be investigated; and new evidence will be uncovered.

Thus the student should not study with the belief that in the field of psychology and education the answers to his problems are known absolutely. There is much today that will still be sound and valuable many years from now, but psychology and education are like streams flowing with different speeds, changing their courses, and always cutting into new areas. New interpretations, different theories, and reemphases are probably more the rule in the field of educational psychology than in most other fields of study.

As has been stated above, because of its dynamic and transitional nature, the student and teacher should not study educational psychology with the belief that they are acquiring facts that are eternal truths. It is desirable and even essential that they be familiar with the evidence, but it is important also that they have a speculative attitude, that they evaluate and weigh and make their conclusions tentative. They should remember that new evidence is always being submitted and modification and verification are always taking place.

Not in harmony with the points of view expressed above was the attitude of a student with whom the author came in contact. An instructor had presented seven points which the students copied into their notebooks. The next morning he said to his class, "I have just received a letter from a colleague who has been doing research on the subject that we discussed yesterday, and he has given me new evidence. We'll have to change one of the seven points and add another." Whereupon the student complained: "I wish the prof would stay put and not make any changes after he has once given us the points of a topic."

It is necessary to have the attitude of the true scholar. First of all the student should thoroughly acquaint himself with the evidence. When the evidence is understood, it should be evaluated and criticized; weaknesses should be found, if possible, and causes and effects sought for. Discussion is helpful, and reasonable skepticism desirable.



## CHAPTER II

### PHYSICAL GROWTH AND DEVELOPMENT

**Directions for Study.**—Two terms, *growth* and *development*, are used, and their meanings need to be carefully studied. Various phases of growth are discussed: prenatal; the few years of rapid growth following birth; the period of steady growth from the fourth year of life to the adolescent spurt which starts at about eleven or twelve and after three or four years gradually slows down as maturity is approached. (In the case of height, maturity is reached at the ages of about eighteen and twenty.)

The relationship between weight and height is set forth, and the reader should note this.

There is also a relationship between age and certain health problems. Note that certain physical weaknesses and diseases are more characteristic of some ages than of others.

Will every small child become a small adult; and, correspondingly, what is the relationship of medium-size and large children to adult size?

Evidence is given that shows that an adult is not merely a child grown up. Be able to explain that statement.

Various parts and organs of the body grow at different rates from birth to the age of twenty. Observe those differences, and learn what their implications are for education.

Physical education and athletic programs should take into account the stage of children's physical development. Basketball, football, and track are discussed from this point of view. What should be some of the objectives of a good health-education program?

Special attention is devoted to the growth of the brain as a whole and also according to its layers. Study carefully the nature of this growth, and observe the implications of this growth for education.

Do the physically well developed tend to have better brains, and do those that have better brains tend to be better developed physically? How strong is the tendency?

Ordinarily, the term *growth* refers to increase caused by becoming larger and heavier. We speak of growth of the muscles, growth of the brain, growth of the skeleton, and growth of the body in general. We usually measure growth in inches and in pounds.

Development is related to growth but indicates more specifically the change in character that takes place. Bones, for example, grow and become larger, but they also develop by changing their composition and becoming harder. The skull grows from infancy, but it also develops by filling over the "soft spot," the fontanel. At birth, a child is born with the number of his brain cells determined, and they grow larger, but they also develop by undergoing chemical change and by the formation of the medullary sheaths. Thus a child not only grows into manhood but develops also. Furthermore, the bodily parts change their sizes relative to each other. The head becomes proportionally smaller as children grow older, and the muscles become proportionally a larger part of the body. Internal changes take place also with the increase in the activity of some glands, such as the sex glands; and decrease in the activity of others, such as the pineal. Changes of this kind influence development and are coordinate with it.

**Prenatal Growth.**—A child has his beginning when the germ cell of his father fertilizes the germ cell of his mother. From a very small speck, the embryo grows and develops for a period of approximately nine months. Embryonic growth is slow in the absolute sense during the first part of gestation but very rapid relatively. There is a very slow increase in weight and size to begin with, even though the fetus multiplies in weight more rapidly just following conception than at any other time. The proportional increase is greater even though the absolute increase is less, because the human being is so small at the beginning. An increase of one milligram of a living organism that weighs much less is a greater proportional increase than an increase of 3 pounds in the case of an organism that weighs 4 pounds. The latter is approximately the increase that occurs during the last few months of gestation.

**Physical Growth of Children.**—Girls at birth weigh, on the average, about 7 pounds; boys, about  $7\frac{1}{2}$  pounds. Babies vary from these averages, but those under 5 pounds at birth have less

chance of survival. Tables I and II give weights for ages from five to fifteen, including essentially all grade-school and even some high-school children(1). The weights are for various ages and are according to height. The range excludes both the highest and the lowest 10 per cent of the children. Thus the weights are for the middle 80 per cent. In order to illustrate how to interpret this table, consider the data given for a seven-year-old boy who is 47 inches tall. Of boys seven years old and 47 inches tall, 80 per cent weigh between 47 and 55 pounds, but 10 per cent are below 47 pounds, and 10 per cent are above 55 pounds. It is assumed that if a boy's weight falls below 47 pounds and thus is included with the lightest 10 per cent, he deviates so much from the average that he requires special attention. Similarly for those who are above 55 pounds and are thus in the heaviest 10 per cent. It is a safe rule to conclude that too much deviation from the average either above or below is an unhealthful indication. In this instance, the lowest and highest tenths are regarded as including those who deviate so much that they may be considered as being outside the normal range.

There is so much of a range or variation for age and height that each child constitutes an individual case. For example, girls 44 inches tall have about the same weight range—40 to 47 and 40 to 48—for the ages ranging from five to eight. Furthermore, eight-year-old girls range in height from 43 to 55 inches and have corresponding "normal ranges" of weight from 38-46 to 66-81. These norms are general guides, but each child must be considered separately, and his growth and health status determined by careful examination. It will be found that a few who deviate so much in weight according to age and height that they are in the extreme tenths may be in good health and not pathological in any sense. Furthermore, there are those who are average according to height and weight and still not in good health.

In determining the individual child's height-weight status, his general structure should be examined and interpreted in terms of his hereditary background, for conceivably a child may be of family stock that tends to be either underweight or overweight, whereas some families tend to be of the slender and apparently frail type but are people of good health and long life. Still other families tend to be heavy and stocky and also of good health.

TABLE I.—RANGE OF WEIGHT FOR HEIGHT AND AGE\*  
Five to Fifteen Years  
Boys

| Height,<br>inches | 5     | 6     | 7     | 8     | 9     | 10     | 11     | 12      | 13      | 14      | 15      |
|-------------------|-------|-------|-------|-------|-------|--------|--------|---------|---------|---------|---------|
| 39                | 34-40 | 34-40 |       |       |       |        |        |         |         |         |         |
| 40                | 35-41 | 35-41 |       |       |       |        |        |         |         |         |         |
| 41                | 36-42 | 36-43 | 37-44 |       |       |        |        |         |         |         |         |
| 42                | 37-44 | 38-45 | 38-45 | 39-46 |       |        |        |         |         |         |         |
| 43                | 38-45 | 39-46 | 39-46 | 40-47 |       |        |        |         |         |         |         |
| 44                | 40-47 | 41-48 | 41-48 | 41-49 | 42-51 |        |        |         |         |         |         |
| 45                | 42-49 | 43-50 | 43-50 | 43-52 | 44-53 |        |        |         |         |         |         |
| 46                | 44-51 | 45-52 | 45-52 | 45-54 | 46-55 |        |        |         |         |         |         |
| 47                | 46-53 | 47-54 | 47-55 | 47-56 | 48-57 | 48-58  |        |         |         |         |         |
| 48                |       | 49-56 | 49-58 | 49-58 | 50-59 | 50-60  | 50-62  |         |         |         |         |
| 49                |       | 51-60 | 51-60 | 52-62 | 52-62 | 52-63  | 52-64  |         |         |         |         |
| 50                |       | 54-63 | 54-63 | 54-65 | 54-65 | 55-66  | 55-67  | 55-68   |         |         |         |
| 51                |       |       | 57-66 | 57-68 | 57-68 | 57-69  | 57-69  | 57-71   |         |         |         |
| 52                |       |       | 60-70 | 60-71 | 60-71 | 60-72  | 60-74  | 60-74   | 60-75   |         |         |
| 53                |       |       | 62-73 | 62-74 | 63-75 | 63-76  | 63-76  | 63-77   | 63-78   |         |         |
| 54                |       |       |       | 63-76 | 64-77 | 64-78  | 65-80  | 66-81   | 66-81   | 66-82   |         |
| 55                |       |       |       | 65-78 | 67-80 | 67-81  | 67-83  | 68-84   | 68-85   | 69-86   |         |
| 56                |       |       |       |       | 70-84 | 71-85  | 71-87  | 71-87   | 71-88   | 73-90   | 74-92   |
| 57                |       |       |       |       | 73-87 | 74-89  | 74-91  | 74-91   | 75-93   | 76-95   | 77-96   |
| 58                |       |       |       |       | 76-91 | 77-93  | 77-95  | 77-96   | 78-97   | 80-99   | 81-101  |
| 59                |       |       |       |       |       | 80-98  | 80-99  | 81-101  | 82-102  | 83-103  | 84-104  |
| 60                |       |       |       |       |       | 84-101 | 84-103 | 85-104  | 86-106  | 86-107  | 87-108  |
| 61                |       |       |       |       |       |        | 87-107 | 88-109  | 89-111  | 90-112  | 91-113  |
| 62                |       |       |       |       |       |        | 91-112 | 92-113  | 94-116  | 95-118  | 96-119  |
| 63                |       |       |       |       |       |        | 95-117 | 96-118  | 97-121  | 99-123  | 101-125 |
| 64                |       |       |       |       |       |        |        | 99-122  | 101-125 | 104-129 | 106-131 |
| 65                |       |       |       |       |       |        |        | 104-128 | 106-131 | 107-133 | 110-137 |
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\* STUART, HAROLD C., *Healthy Childhood*, D. Appleton-Century Company, Inc., p. 68.

Prepared by Dr. H. K. Faber for the San Francisco Tuberculosis Association. Figures based on measurements of California school children.

The weights given represent the approximate permissible range for normal children. Underweight is calculated as pounds under the lower figure; overweight, as pounds over the higher figure. Percentages of underweight and overweight are not to be computed from these tables. Children whose weights are not within the given range should receive special study and attention. Children whose weights are within the given range are not necessarily free from physical defects nor are the others necessarily physically defective.

Of the total weight of children's bodily structure, the proportion of flesh, or muscle, varies considerably among children, as does the proportion that the skeleton is of the total. Pupils vary in the breadth and thickness of their skeletal development as well as its height, so that weight in terms of height and age is sometimes not a reliable index to nutritional status. Examination should be made of the breadth and depth of the skeleton and also of the subcutaneous tissue, and the muscular development also should be carefully taken into account. Conceivably a child of small skeleton may have plenty of flesh on the bones, so to speak, and still be quite light in terms of the standards. There may also be children with large skeletal growth who may seem heavy enough according to their height, but whose tissue development indicates that they are inadequately nourished.

**Health and Weight.**—There is a relationship between disease and weight of the body. Ordinarily, it is considered desirable for children and young adults to be slightly overweight rather than underweight. After the age of thirty or thirty-five, the opposite condition is preferable, as it is then better to tend toward being slightly thin than fat.

Such conclusions are based on the relationships that have been found between weight and disease. Children of good weight tend to be healthier than those who are underweight. Tuberculosis particularly is associated with underweight, as children and young adults who are underweight are much more frequently infected than are the overweight. The evidence of diabetes, on the other hand, is more frequent among the overweight. Data on longevity obtained on those carrying life insurance indicate that the death rate for all diseases except tuberculosis is greater among those who are overweight.

Too much significance should not be attached to weight as an index to the state of a person's health. Still, the achievement of a more nearly normal weight is usually accompanied by improved health. Thus if a person who is "naturally thin" builds up his weight, he probably will be in better health; and if those who are "naturally fat" diet and achieve more nearly normal weight, their health will be improved. In so far as wise eating and good living are reflected in weight, it can be controlled for good health. Obviously if a child is underweight because he is undernourished or malnourished, good feeding will improve

TABLE II.—RANGE OF WEIGHT FOR HEIGHT AND AGE\*  
Five to Fifteen Years  
Girls

| Height,<br>inches | 5     | 6     | 7     | 8     | 9     | 10     | 11     | 12      | 13      | 14      | 15      |
|-------------------|-------|-------|-------|-------|-------|--------|--------|---------|---------|---------|---------|
| 39                | 33-38 | 33-39 |       |       |       |        |        |         |         |         |         |
| 40                | 34-41 | 34-41 |       |       |       |        |        |         |         |         |         |
| 41                | 35-41 | 35-42 | 36-43 |       |       |        |        |         |         |         |         |
| 42                | 37-44 | 37-44 | 37-44 |       |       |        |        |         |         |         |         |
| 43                | 38-45 | 38-45 | 38-46 | 38-46 |       |        |        |         |         |         |         |
| 44                | 40-47 | 40-47 | 40-48 | 40-48 |       |        |        |         |         |         |         |
| 45                | 42-49 | 42-49 | 42-50 | 43-50 | 43-52 |        |        |         |         |         |         |
| 46                | 44-51 | 45-53 | 45-53 | 45-54 | 45-54 | 45-56  |        |         |         |         |         |
| 47                | 46-53 | 46-55 | 46-55 | 46-56 | 46-57 | 46-58  |        |         |         |         |         |
| 48                |       | 47-57 | 48-58 | 48-58 | 48-59 | 48-60  | 49-62  |         |         |         |         |
| 49                |       | 50-59 | 51-61 | 51-62 | 51-62 | 51-64  | 51-66  |         |         |         |         |
| 50                |       | 53-63 | 53-63 | 53-64 | 53-66 | 54-67  | 54-69  | 56-72   |         |         |         |
| 51                |       |       | 55-67 | 55-67 | 56-69 | 56-70  | 57-72  | 58-74   |         |         |         |
| 52                |       |       | 58-71 | 58-72 | 58-72 | 58-73  | 59-75  | 59-76   |         |         |         |
| 53                |       |       | 61-73 | 61-74 | 62-76 | 62-78  | 62-78  | 62-80   | 62-82   |         |         |
| 54                |       |       |       | 63-77 | 64-79 | 64-81  | 64-82  | 65-83   | 66-85   |         |         |
| 55                |       |       |       | 66-81 | 67-82 | 67-84  | 67-86  | 68-88   | 69-90   | 70-91   |         |
| 56                |       |       |       |       | 70-86 | 70-88  | 70-90  | 71-92   | 73-95   | 74-96   |         |
| 57                |       |       |       |       | 73-89 | 73-91  | 74-94  | 75-96   | 77-99   | 78-102  | 82-106  |
| 58                |       |       |       |       |       | 76-95  | 77-98  | 78-100  | 80-103  | 83-108  | 86-111  |
| 59                |       |       |       |       |       | 80-100 | 81-104 | 82-106  | 84-109  | 86-112  | 90-117  |
| 60                |       |       |       |       |       | 84-105 | 85-108 | 86-110  | 87-113  | 90-117  | 95-123  |
| 61                |       |       |       |       |       |        | 89-114 | 90-116  | 91-118  | 94-122  | 98-128  |
| 62                |       |       |       |       |       |        | 94-120 | 95-122  | 95-124  | 97-126  | 102-132 |
| 63                |       |       |       |       |       |        |        | 99-128  | 100-130 | 101-131 | 105-137 |
| 64                |       |       |       |       |       |        |        | 103-132 | 104-135 | 105-137 | 108-140 |
| 65                |       |       |       |       |       |        |        | 106-137 | 108-140 | 110-143 | 111-144 |
| 66                |       |       |       |       |       |        |        |         | 112-145 | 113-147 | 114-149 |
| 67                |       |       |       |       |       |        |        |         | 116-151 | 117-152 | 118-153 |

\* STUART, HAROLD C., *Healthy childhood*, D. Appleton-Century Company, Inc., p. 68.

Measurements are to be taken in indoor clothing, without shoes, coat, or sweater. Heights are best taken with heels and head against a wall on which an accurate scale with half- or quarter-inch divisions has been marked or fastened. The head must be level, and the body as erect as possible. The age is taken as that of the nearest birthday.

his health materially. The science of nutrition has advanced so far and made so many contributions that its worth should not be minimized. It is conceivable that if a child is scientifically fed and still tends to be too much underweight or overweight, the cause lies in organic conditions, which are frequently responsible

for considerable deviation in weight, lessened resistance to disease, and shorter life. Even though the weight of an individual may be controlled to be more nearly normal, yet there may still be doubt that by such control his fundamental health has improved materially or that he will live significantly longer because of it. Changing an extreme weight condition through sustained effort is desirable, but still weight may be a symptom of an organic or bodily weakness, and therefore no very fundamental improvement effected. Nevertheless, each individual should maintain as good nutritional status as wise eating and living can produce.

**Age and Health throughout Childhood.**—The most critical period for a child is at the time of his birth and the days immediately following. Death rates are highest in early infancy although not so high now as they were several decades ago. If a child survives infancy, the probability is high that he will reach adulthood. The death rate among children of school age is low, reaching its lowest point at about fourteen.

Sickness is common among children but seldom fatal. Young children are most apt to contract measles, whooping cough, scarlet fever, diphtheria, meningitis, and chicken pox; adolescents and young adults are more apt to contract tuberculosis, mumps, venereal diseases, digestive trouble, and appendicitis. Adolescents are also affected more with headaches, and eye defects show up to a great extent during the teens.

Colds of one kind or another affect all ages and probably disable children and adults for more days than any other single form of illness. If we could prevent colds, we should go a long way in maintaining individual and general health. Probably the best preventative against the cold as well as most diseases is the maintenance of healthful surroundings and the healthy condition of the individual. Then the individual is less apt to become infected and, if he should, will probably be affected less seriously.

The growth of the muscular and skeletal system contributes a large proportion to the increase in weight acquired during the growing years. Well-controlled play and exercise will help produce a healthy growth of the muscular and skeletal systems and thus develop a healthful mechanical balance and organization of the body. Exercise can be of most developmental importance if adapted to the natural growth of the boy and girl.

In this connection, it may be added that the maintenance or achievement of good posture is not the result alone of the individual's "standing straight." Standing straight helps, but good posture probably is more the result of healthful growth and development. If growing boys and girls have to work so hard or if they engage so strenuously in athletics that they are tired much of the time, they are apt to "slump" and develop poor posture. Consequently a mode of living resulting in a good physical condition is conducive to good physical equilibrium, or posture.

It is not implied of course, that special work on health and posture is not desirable and often necessary. It is; but we should not lose sight of the fact that sound general health tends to bring about good postural development and thus makes unnecessary much, but not all, special attention to physical defects.

Adequate rest and sleep are important in this connection. People of all ages will avoid fatigue and be more efficient if they reserve certain periods of the day for leisure and rest. Meal-times can be extended a few minutes so that they are not hurried through, and a rest can be taken afterward. A siesta is most restful and helps establish a leisurely tempo rather than one of hurry and scurry. The tensions that accompany excessive activity are said to have a bad effect on the heart, and the increase in deaths because of various forms of heart disease has been attributed to our high-speed living.

The optimum amount of sleep varies from person to person according to individual needs. Young children need more sleep than older ones. Infants sleep eighteen and twenty hours of the twenty-four; adults, usually seven to nine. It is difficult to say that a child of a given age should sleep a definite number of hours. If a child or adult goes to bed fairly early, sleeps in a good bed in a comfortably cool room, and sleeps until he awakens naturally, he will probably be well rested. A growing person should go to bed earlier than an adult, but both children and adults can profit by having a regular bedtime, and the value of an early bedtime is that it assures a longer period of rest. Even though it is said that we spend one-third of our lives in bed, we should not regard that time as wasted, because all of it, and probably more, is essential for good living.



**Relation between Height in Childhood and Height in Adulthood.**—Is growth among children consistent from year to year so that the relationship in size remains relatively constant? In other words, does the short child turn out to be a short adult, an average child an average adult, and a tall child a tall adult? In general, such is the case, as height in childhood indicates adult height, but there are exceptions. Dearborn, for example, has found that when curves are drawn to depict growth in height, there are those which indicate that the relative height of some children does not remain constant(2). Such change occurs probably in the case of one child in five. Thus, some children turn out to be considerably taller or shorter adults than might be predicted from their heights as children.

Growth varies in speed from individual to individual and varies also during the growth period of any one person. There are periods when growth is more rapid than at others, but it does not fluctuate in the sense that it is jumpy. There are some individual fluctuations; but the curve showing growth over a period of years is a relatively smooth one, indicating a more rapid growth during some periods of life than at others but nevertheless showing a steady consistent growth.

#### DIFFERENTIAL GROWTH

Figure 1 shows the more obvious changes that occur in the human body in its development from the fetal stage until maturity. The head and torso are largest in the early years of life and grow proportionately smaller; the arms and legs become proportionately longer. The muscular and skeletal parts of the body develop with growth and become relatively more important as adulthood is reached. Because adults are highly dependent on sound skeletal and muscular structures, that fact is consistent with the order of things that growth should be expected to bring about. Consistent with the foregoing our bone structures and muscles are comparatively weak in old age. It is apparent from Fig. 1 that an adult is not a child grown larger but that a child changes while growing and reaches adulthood quite different physically from what he was as a child.

**Development of Bodily Parts.**—General growth and development has been described, but growth of various parts of the body will help us understand more fully the nature of human develop-

mont. Specifically it will help us understand our educational, health, and emotional problems more fully. Figure 2 shows the course of growth with age of lymphatic, neurological, gross body, and genital structures. The curves differ considerably and give us a basis and explanation for different educational procedures.

In order to establish in mind the nature of growth in general, consider curve C. It summarizes the description of growth that has been presented. Growth is most rapid the first two years of life, after which the increase is less rapid but fairly steady until age twelve is reached. Then there is an acceleration. At sixteen there is a slowing down again, and between eighteen and twenty there is only a small increase in growth.

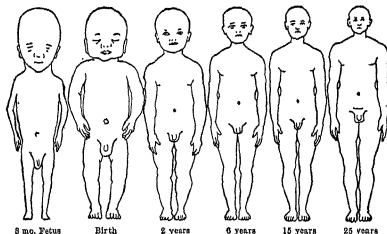


FIG. 1.—Changes in body proportion, fetus to maturity. (From drawings by Scammon, Calkins, and Stratz, courtesy of Harold C. Stuart, *Healthy Childhood*, D. Appleton-Century Company, Inc.)

The curve for growth of the genital parts parallels the curve of general growth to some degree, whereas the other curves do not. The growth of the genital parts is slow during the first twelve years of life, showing very little increase. Between the ages twelve and fourteen there is a rapid spurt which continues with just a little slowing down before the age of twenty. It should be remembered that the curves are based on the age twenty by indicating the percentage that the growth at any age is of that age.

The curve for the lymphatic system differs from the others. It reaches its peak at twelve and then declines rapidly. At this age when growth in general and genital growth in particular begins to be rapid, the opposite trend is taken by the lymphatic system.

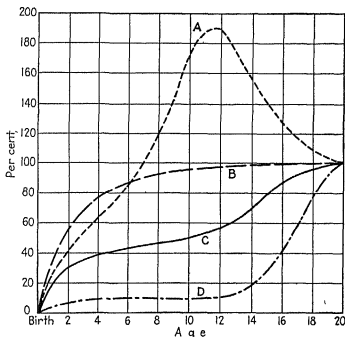


FIG. 2.—The major types of postnatal growth of the various parts and organs of the body. The several curves are drawn to a common scale by computing their values at successive ages in terms of their total postnatal increments (to twenty years). *A*, lymphoid type: thymus, lymph-nodes, intestinal lymphoid masses. *B*, neural type: brain and its parts, dura, spinal cord, optic apparatus, many head dimensions. *C*, general type: body as a whole, external dimensions (with exception of head and neck), respiratory and digestive organs, kidneys, aorta and pulmonary trunks, spleen, musculature as a whole, skeleton as a whole, blood volume. *D*, genital type: testis, ovary, epididymis, uterine tube, prostate, prostatic urethra, seminal vesicles. (From Harris, Jackson, Paterson, and Scammon. *Measurement of Man*, University of Minnesota Press, 1930.)

The lymphatic system, consisting of vessels, lymph, and glands, helps to take care of waste material and the bacteria of the body. It functions to destroy the bacteria, but sometimes the lymph glands are infected and swell. The tonsils and adenoids are included in this category; nevertheless, they should not be removed on first suspicion of infection.

It may be pointed out that at approximately the age when the lymphoid type of body material has reached its maximum development, the death rate is lowest. There may not be a causal relationship between these two facts; but because of the function of the lymphatic system, it is of interest to point out the possibility that there is one. The body is such a complicated mechanism, affected and controlled by so many factors, that cause and effect relationship involving organic systems should not be drawn too hastily. Still, one should always look for relationships.

### PHYSICAL GROWTH AND EDUCATION

Comment has been made on how educational procedures and the curriculum should take account of the rapid growth of the nervous system. Psychological tests show that the growth of mental ability is not so rapid as that of the nervous system, but the trend is very much the same. In view of the data from both sources, it is safe to conclude that so much attention need not be put on formal academic work during the early school years as we now do. We now engage in that pedagogical chicanery known as primary methods and devise all sorts of techniques in order to teach the child; whereas if we waited a bit, mental growth would solve most of the teaching difficulties experienced in the primary grades. Formal education should receive emphasis in the teens and during maturity rather than in the period when mental growth is so rapid.

The teens, or the age of adolescence, is a particularly critical period, not from a purely academic or subject-matter point of view alone but from one pertaining to emotional and social adjustment. Because it is a period of rapid growth accompanied by organic changes that bring new interests and urges, the problem of successful living is particularly acute.

Adolescents often become tall and gangling. Relatively undeveloped and often unattractive, they are frequently the butt of humiliating remarks. The boys outgrow their clothes rapidly. Their hands and feet stick out from sleeves and trousers too short for them; and the total effect is an appearance of awkwardness.

About the time of puberty, hair begins to grow on the boy's face. At first this is a down, which changes during adolescence to become adult whiskers in a few years. In the first appearance

and growth of this facial hair lies the basis of emotional experience. The funny strips in the newspapers depict the adolescent with his none too apparent but growing facial hair and his juvenile attempts to cope with it. We may laugh, but the wise observer knows that the adolescent is passing from childhood to adulthood and that he needs guidance by those who understand him. The voice also changes during adolescence and often plays tricks on the owner by breaking. The awkwardness of adolescents manifests itself in one way or another. They should not be the butt of jokes. Instead, they should be treated sympathetically.

During the junior and senior high-school years, the problem of parent and teacher pertains more to personal adjustment than to history, algebra, or Latin. The boy and girl is passing through adolescence from childhood to adulthood, and the problems of personal happiness and mental health are primary. It is a period of conflict because of biological urges which are stirring within.

The rapid growth and maturation of the genital, or sexual, organs is accompanied by the intensification of related interests and urges. At this time, boys and girls become increasingly interested in each other; and in the high school and college also, the problems in social relationships and sex matters challenge parents and teachers much more than do those pertaining to the quality of achievement in mathematics or history. During the teens, boys and girls make the various gestures that are preliminary to mating. Because the boy-girl relationship is inevitable and the result of this relationship is so exceedingly significant, the topics pertaining to it should be discussed. Boys and girls can be made intelligent about the anatomy and physiology of the human body, and the teaching should be directed toward problems of behavior and social hygiene.

Merely factual instruction will not suffice, and even good teaching in this field is not enough. The school, the church, and the home can sponsor recreational and activity programs that will bring young people together in a wholesome atmosphere. A wisely planned program of instruction and activity will help carry adolescents safely to adulthood through that turbulent period which growth brings about in its rapid development of genital parts during the teen years of life.

During adolescence, boys and girls reach a developmental stage when their thoughts converge on adulthood and more

specifically on a career. The teens, especially the middle and later ones, are the propitious times for educational and vocational guidance. Measurements of abilities and interests are more valid when obtained at or near mental maturity. Boys and girls in their high-school years make important choices about their educational and vocational careers, and such choices should be based on the best information available on the suitability of the individual for the career and the availability of such careers.

**Growth, Maturation, and Health Education.**—When lower forms are born, it is only a short time before they are competent to cope with their environment. Baby birds, for example, are dependent on their parent birds for only a short time, and fish almost as soon as hatched can make their own way, so to speak. The period of infancy for human beings is relatively long, and consequently the control of growth and development is particularly significant.

Our health and physical education should be controlled by our knowledge of growth and maturation. Cognizance should be taken of the rate of growth as indicated by increases in both height and weight. Certain objective facts about growth should be set forth before this topic is discussed in detail. There are different growth curves for the sexes, especially when the teens are being reached and during them. Before the adolescent years, there are only slight differences.

Increase in height is most rapid during the first year of life, after which the increases are successively smaller each year until the fourth year is reached, and then the average annual increase in height from age four to eleven is about 2 inches. At eleven, the girls increase more rapidly; and during the ages eleven, twelve, and thirteen, they average nearly 3 inches, after which there is a rapid decline in the average increases. After the girls are eighteen years of age, there is very little increase in height.

Boys increase in height approximately as much as the girls until the age of ten or eleven, when, as has been stated, the girls begin to increase more. At thirteen or fourteen, the boys increase more than the girls; and during the ages fifteen and sixteen, the boys average an increase in height of about 3 inches. After the ages of nineteen and twenty, boys increase very little in height. The adolescent spurt for the girls begins at about eleven, and for the boys it begins at about twelve.

In weight, too, the increase is very great during the early part of life; but after the age of three and until eleven, the average annual increase in weight is from 4 to 6 pounds. Then there is a rapid increase for both girls and boys—more for the girls of eleven, twelve, thirteen, and fourteen. At the age of about fourteen, the average weight increase for the girls is about 12 or 13 pounds. The boys at sixteen experience an average increase of about 15 pounds. After these maximum increases, the amount of annual increase is several pounds less each year until the age of twenty is reached, when the annual increment in weight is ordinarily less than 2 pounds.

Puberty may be defined as the earliest age at which a person can beget or bear children. For girls, this age is most commonly twelve, thirteen, and fourteen, and menstruation marks its beginning. Boys reach puberty a little later at thirteen, fourteen, and fifteen, at which ages their genital organs produce sperm cells. These ages do not include all girls and boys but most of them. Some reach puberty earlier, and others reach it later than the years given.

**Age and Physical Maturity.**—These facts leave unanswered the questions that may be raised about the age when physical maturity is reached and when decline begins. Observation of athletes and their development indicates that maturity is reached on the average at the age of about twenty-five. Men that are smaller than average tend to mature two or three years before twenty-five, and large men reach physical maturity at the ages of twenty-seven or twenty-eight. The ages between twenty-two and twenty-eight may be considered those during which physical development reaches its highest point. Laboratory studies also indicate that fact. Of one fact we can be absolutely certain, and that is that boys and girls of high-school age are not mature. The heart is relatively small at this time. The heart of the adolescent and the arteries leading from it are still developing and will become considerably larger. The same is true of several other organs. They are growing and have grown so rapidly that when they are considered mature, in reality they are immature.

**Athletics and Physical Development.**—Competitive high-school athletics can hardly be good for the health of those who participate in them. Boys and girls fifteen, sixteen, seventeen, and even eighteen years of age are developing rapidly. They are

green and immature and lack endurance. During these periods of rapid growth, the adolescent needs carefully regulated exercise and rest. At no age in life, even in the mature twenties, does exhausting play or work have a good effect on health.

Some of the high-school schedules for football and basketball are too severe. The injuries that boys suffer in football and sometimes in basketball leave a weak knee, ankle, or shoulder that troubles the victim throughout life. These are serious enough; but the strenuous schedules that boys play, especially in basketball, overlook the health values of games and athletics. High-school basketball teams often play two or three games a week and a total of over 20 games during a short season. On top of the regular schedule, there follow in many states district, regional, and state tournaments which cause some teams to play very intensive short schedules. Raw, green youth is not physically adapted for playing such exhausting schedules, and it is probable that the health of even a seasoned adult would be affected by it.

Questions may also be raised about the effect of high-school athletics on adolescents who do not participate in the games, but who as fans develop enthusiasm for their team that runs almost to hysterics. Before and after games and more intensely during them, the tensions and excitement of the students may be too intense. Interest in and attendance at games for which there has been a considerable "build-up," along with so many other impacts that young adolescents experience, may cause them to be overstimulated.

The failure of high-school athletics to fit into the growth and developmental status of high-school students applies in some but in lesser degree to college athletics as well. Most college athletes are not completely matured physically. Boys nineteen, twenty, and twenty-one years of age are approaching physical maturity but have hardly reached the age of physical acme. Even if they were completely mature physically, there is considerable doubt if exhausting or bruising athletics such as track, basketball, and football is healthful. Possibly we should be frank and should candidly admit that high-school and college athletics of a highly competitive sort are not best for the health of the students. Yet the activities sponsored by educational institutions can be made conducive to the healthful growth and development of their pupils.



**Health Education.**—In the health program, diagnoses can determine how well a child is developed. When weaknesses are discovered, remedial work can be directed to correcting individual defects. During childhood and adolescent years, more can be done for posture, for example, than at any other time. Corrections are most easily made before maturity is reached. Furthermore, if a fatigued condition is prevented, and children are kept in good physical condition, they are less apt to slump into poor posture. Rather than exhausting pre-adults by fiercely competitive athletics, modern physical education should concern itself with the health of the individual students. Exercises and play most conducive to individual development need to take the place of sharply competitive games.

Growth and development are the most important processes experienced by children, and their education should be in cooperation with nature. Nutrition, too, is exceedingly important, and children can be taught good eating habits. It is also essential, of course, that children be given enough good food; and if society cannot provide it, then the teachers will be handicapped in their attempt to facilitate proper development.

A child needs good food, adequate sleep and rest, and healthful play and exercise in order to further his growth and development. The formation of good health habits is of primary importance. The achievement of good health is an objective in itself and should not be interpreted in terms of increased I.Q. or improved school achievement. It really does not matter very much that an improved health condition does not reflect itself in raising a child's I.Q. or results only in a small improvement in school work, because good health in itself is consistent with the best order of things.

The factors that contribute to growth and development should come first, and formal education second. A good diet tends to leave a child less nervous and in a more stable condition so that he can respond more effectively to his environment. An experiment was conducted to test the effect of drinking milk which, for one group of children, contained a pleasant-tasting concentrate of calcium, phosphorus, maltose, and lactose(3).

In this experiment, some children from grades one, three, and five were not fed at 9:30 A.M.; some received milk only; and some received milk plus the food concentrate that has been described.

The pupils were rated by teachers at the beginning and end of a two-weeks period for worry, emotional calmness, temper, criticalness, excitability, and other characteristics, and it was discovered that there was about an 8 per cent improvement among those who were given the milk and about 16 per cent among those given both milk and the food concentrate. There were, of course, individual differences in improvement, some showing much greater change than others.

In such an experiment as this, which covered only a short period of time and involved a rating scale, there is certain to be a considerable degree of unreliability. Still, one can place some faith in the general trend and conclude that if a little supplementary feeding in the middle of the morning causes children to be less nervous and more stable, we have an index at least to what effect scientific feeding based on an ample diet will have on the health of growing children and even on adults, for that matter.

A child's ability to cope with the circumstances that surround him and his general relationships to his environment are dependent in large part on his stage of growth and development. His physical ability is closely related to size, and potential mental power is dependent on the stage of growth of the brain and the rest of the nervous system. Emotionally and socially, girls and boys of sixteen are different from those of six, because they have grown larger and because of certain organic and glandular changes that the increase in years has brought about. Mental capacity, physical power, and social reactions depend to a large degree on the stage of physical growth and development, and the same is true to some extent of emotional control and adjustment.

#### GROWTH OF THE BRAIN

At birth, the brain constitutes a larger percentage of the total body weight than at any subsequent time. It is then about one-eighth the total body weight, whereas in adulthood it is only about one-fiftieth of the total weight. This indicates that after birth, proportionately the skeletal and muscular system increases in weight much more rapidly than does the brain.

Nevertheless, in absolute, if not in relative, terms, the brain grows rapidly to approach its maximum development. At the age of four, approximately 80 per cent of the total weight is

attained; at the age of eight, slightly over 90 per cent; and at sixteen, about 98 per cent of the total weight is reached. Figure 3 traces the growth of the brain from birth to advanced old age. The steepness of the curve for the first three to four years depicts how rapidly the brain increases in weight and incidentally in size. Before five, the growth has become less rapid, and throughout the teens the increase is relatively slow. The curve shows that maximum development is reached in the twenties at ages about twenty-three or twenty-four. Some authors indicate that the brain reaches its maximum growth at about twenty rather than at a slightly later age. It is an accepted fact, however, that very little if any increase occurs during the third decade of life.

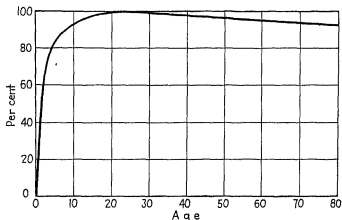


FIG. 3.—Growth and decrease of the brain from birth to old age.

The curve indicates that following the maximum weight, which is reached at twenty or twenty-five, there is a slight decline in the weight of the brain. Also, the brain changes chemically as it grows older. The percentage of fat increases, particularly during the growth of pre-adult years and somewhat during childhood. The percentage of proteins decreases, as do also the percentages of sulphur and phosphorus. These changes influence the weight of the brain and probably affect its quality, or its functional capacities, as well. The principle cause, however, of the decline in the weight of the brain after maturity is reached lies in the loss of the water content. We do not have sufficient data on which to make any conclusions about the functional effect of the loss of brain weight during adulthood on intelligence; but, on the other

hand, we do know that the growth of the brain during childhood is accompanied by very significant increases in mental capacity. Possibly the changes that occur following the twenties affect mental capacities. After birth, the number of brain cells does not increase. The number is fixed before birth, but they grow and develop until maturity and undergo some change throughout all of life. These changes, both quantitative and qualitative, are greatest during pre-adulthood and are functionally most important at that time also.

The part of the brain involved more directly in the mental processes is only a small proportion of the total. The brain consists of a thin outside layer of gray matter known as the *cortex*, which constitutes about 2 per cent of the total weight of the brain. The rest of the brain consists of supporting tissue, fatty matter, arteries, and veins.

**Layers of the Brain.**—The cortex is divided into three layers, the supragranular, granular, and infragranular. At birth, these layers vary in the extent of their development, the supragranular layer being developed 50 per cent; the granular, 75 per cent; and the infragranular, about 82 per cent. These layers have different functions, the supragranular being most important when the mental processes are complex. It is closely related to mental ability and is poorly developed in the feeble-minded. It reaches maturity last and is most important educationally.

The granular layer, which is about three-fourths developed at birth, is a medium for conducting the sense impressions. The infragranular layer, which has reached about 82 per cent development at birth, is concerned principally with instinctive responses and reflexes. In infancy or at childhood, the brain layers are developed according to the extent to which they insure survival. A child must depend most on its instinctive responses, and consequently the more primitive layers are most developed at birth. As he grows to adulthood, he develops his abstract mental abilities, and they become correspondingly more important. Consequently, the supragranular layer develops at such a rate as to reach maturity last.

✓ **The Brain and Education.**—Educators might wisely take a cue from the nature of the differential growth of the brain. During the first years of life, education should be built on instincts, reflexes, and the simpler sense impressions. An informal program

of activities involving the grosser bodily movements and the development of the senses and perception is most suitable to the younger child's stage of mental and physical development. The more formal school work involving words and symbols can be profitably delayed until the brain has reached a stage of development more suitable for coping with the more abstract phases of education.

We know only in a very general way how the brain functions in the learning processes. Still, we know enough about the brain and its growth to state that it is unwise to introduce children to the rigors of formal learning as early as we now do. The results of mental tests substantiate also what we may deduce from the growth of the brain. During the years of greatest growth of the brain, the growth in mental ability is also greatest. For example, children four years old answer questions of a mental test with considerably more accuracy than do children who are three years old. The same is also true for the five-year-old over the four-year-old, the six-year-old over the five-year-old, and so on. The differences with age levels decrease, and in the teens they are not large. The fourteen-year-olds answer the questions in mental tests with only a slightly higher degree of accuracy than do the thirteen-year-olds; and in the late teens (in some tests), there is no difference in accuracy with an increase in age. This result also agrees with the fact that in the teens there is only a slight growth of the brain.

In the chapter *Intelligence and the Capacity to Learn*, growth of mental ability is discussed; and that discussion is supplementary to the preceding pages dealing with the growth and development of the brain. Interpreting one in terms of the other will help explain the relationship between neurological and mental growth and also show how both should govern educational procedures and how to control the social adjustment of the individual.

**Correlation between Physical and Mental Growth.**—In one sense, there is a high correlation between physical and mental growth. Over an age range from early childhood to adulthood, physical and mental status are highly related, because increase in age is accompanied by both mental and physical growth. In other words, just as physical growth and development of six-year-olds is advanced over that of four-year-olds, ten-year-olds

over eight-year-olds, twelve-year-olds over ten-year-olds, etc., it is correspondingly similar for mental growth and development. Both physical and mental growth correlate highly with age; and consequently over an age range covering the growth period from birth to adulthood, there is a high correlation between the levels of physical and mental development.

If, however, we remove the effect of age and consider children of any given age, then there is only a very low correlation between physical and mental status. For purposes of illustration, we may consider a large unselected group of nine-year-old children. Almost any other age group of children would do just as well. In this group of children, all of whom are nine years old chronologically, will be found a wide range of mental ability. This range may be expressed as probably ranging from a mental age of three to sixteen. The range might be greater and possibly less; but it will probably be found that in a large group of nine-year-old children, there may be a very few who have the mental ability of an average three-year-old; correspondingly, there may be one or more who have the mental age of the typical sixteen-year-old. Most of our nine-year-olds will be at the nine-year-old level, but others will be eight, seven, six, etc., or ten, eleven, twelve, etc. The number decreases as the ages vary from nine.

The facts that describe the mental variation are also descriptive of the physical level of the nine-year-old. A few will be of the size of children considerably younger than nine-year-olds, and some will have the height and weight that are typical of children much older. Thus there will be considerable variation about the average level of physical growth.

If the mental and physical level of these children is correlated, a low correlation of about 0.05 to 0.15 would probably be found. This means that there is very little relationship between the stages of mental and physical growth of this age group. The correlation is low for any age group. This means that almost as often as not, a person of advanced physical development is advanced, average, or retarded mentally. Similarly, if a person is either average or retarded physically, he is almost as likely to be advanced, average, or retarded mentally. The same is true for mental development. One cannot judge accurately a child's physical status from a knowledge of his mental capacity. However, because there is a slight correlation between mental and

physical status, more often than not, high mentality is associated with good physical development. Among a group of bright children will be found more large, well-developed children than among a group of children who are mentally retarded. Consistent with this statement, another can be made to the effect that among a group of physically advanced children will be more children above average intellectually than among a group of small, runty, undeveloped children of the same age. There are, of course, many dull children well-developed physically and many bright ones poorly developed, but hardly a majority. The relationship between mental and physical status of children of the same age is not marked but enough to substantiate the principle that desirable qualities tend to accompany each other.

#### SUMMARY

By growth we mean increase in size primarily, but by development we refer not only to change in size but also to the nature of the change.

Prenatal growth continues for nine months, with the largest growth in pounds taking place the last two or three months. Growth continues very rapidly after birth until the age of three or four; then there is a steady but small annual increase until about eleven for girls and twelve for boys, when growth is more rapid throughout the adolescent period of several years.

Children differ in height and weight at each age, and ordinarily all children are regarded as being of normal height and weight, unless they are in the lowest or highest 10 per cent. Nevertheless, the individual should be studied as an individual, because several factors must be taken into account when health and nutritional status are being determined.

Death rates decrease from infancy to about the age of fourteen, when the death rate is lowest. Diseases vary according to age, the incidence of tuberculosis, for example, being higher during adolescence than during the earlier years. Whooping cough and measles are more common with younger children.

Play and exercise have much to do with good bodily mechanics, and so do good food habits and the control of fatigue. Corrective methods should be accompanied by methods that keep the body in a healthy condition if good posture or body mechanics is to be achieved.

A child's size does not always indicate adult size; in about one case out of five, there is a reversal, the small becoming a moderately large adult, or the large child becoming a rather small adult. The body proportions of a child change as he grows older, his head becoming comparatively smaller, his torso becoming comparatively smaller also, but the legs comparatively longer. There are also differences in the rate of growth in the lymphoid type, neural type, general type, genital type; and a program of health and academic education should recognize them.

The different stages of child growth raise special educational problems. Especially is this true during adolescence, when so much concealed development is taking place as well as the more apparent increase in the size of the body. The problem of emotional adjustment is particularly significant at this time.

Health and physical education, too, should take into account the stage of physical growth and development. Present-day athletics in junior and senior high school and even college are too strenuous for the participants. They do not contribute to the health of the students. The health and physical education program should concern itself more with nutrition, rest, fatigue, and exercise—in short, with the establishment of good health habits.

The brain grows rapidly the first few years of life, attaining 90 per cent of its total weight by the age of eight; and by the age of twenty or by the early twenties, its maximum. There are three layers to the brain having to a considerable extent different functions, and their development is consistent with physical and educational needs of the individual according to his age. Because of the nature of brain growth, education adapts itself best that stresses physical activity and emotional development during the first decade of life; and although those objectives should not be abandoned in the second decade, emphasis may be placed on the acquisition of facts, information, and knowledge. This emphasis may be placed in the second decade and particularly during its latter part and also those years subsequent to the second decade.

There is a slight relationship between a physical and a mental development for any given age, individuals with the best physical development tending to have to a certain degree the best mental abilities, and vice versa.



### Problems and Exercises

1. Give some examples of growth and development.
2. What is meant by relative and absolute growths?
3. There are three ten-year-old boys who are 49 inches tall; one weighs 45 pounds, another 55, and the other 78. How do you classify these boys, and what do you recommend?
4. Discuss the desirable weight status of an individual during childhood, during early adulthood, and beyond the age of thirty.
5. What diseases are younger children apt to catch, and what are the physical illnesses and weaknesses more common to the teens and the twenties?
6. Why is it so important to avoid being in a fatigued condition?
7. Explain whether or not you can predict adult size from child size with little or no error.
8. Explain whether or not an adult is merely a child grown larger.
9. What are the implications for education of the data given in Fig. 2?
10. What are fundamental educational and psychological problems for adolescent boys and girls?
11. Defend or attack the statement that the present athletic programs in our schools are not best for the health of the students.
12. How can an educational program take into account the characteristics of physical growth and development?
13. How can our teaching adjust most effectively to the growth of the brain?
14. What is meant by the statement that the layers of the brain grow according to physical and educational needs?
15. Will children who are considerably above the average in intellectual ability tend to be above or below average in physical ability?
16. If a group of children are classified so that the undersized and weak are in one group, will they tend to be above or below average in mental development?

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## CHAPTER III

### SOCIAL DEVELOPMENT

**Directions for Study.**—Discussion in this chapter centers in a general way on various evidences and manifestations of social adjustment and development. Emphasis is placed largely on the nature of the individuals and their adjustment to the environment.

Study carefully the relationship of social development to physical and mental status, and observe carefully how they are related.

Various forms of antisocial behavior increase with age during the pre-adult years. Observe the frequency of delinquency during the adolescent years.

Sex differences are also discussed, and note the ages at which antisocial behavior is most common.

Enumerate the many causes of antisocial behavior

Why is the problem of social adjustment so important for adolescence?

Be able to discuss the factor of friendship in relationship to social adjustment. Study the various factors about the gang as a social unit.

Prepare yourself to discuss interest in play and games in terms of age.

**Introduction.**—Social development, to a considerable extent, accompanies increase in age. A child of three differs in his reactions to the presence of people from the way in which he will respond when he becomes an adolescent of sixteen. Furthermore, there are sex differences, and boys of sixteen are different from girls of the same age. The behavior of children of the teen and pre-teen age as it pertains to other people will be dealt with here. A person who gets along very well with people is said to have high social intelligence. In this chapter, some of the more apparent phases of social development will be discussed, and its less disputable characteristics will be set forth.

**Relationship of Social to Physical and Mental Status.**—Social development is not separate or discrete from physical or mental growth. They are closely related, as the status of social development is correlated to some extent with mental status. A six-year-old child with a mental age of nine is almost certain to be more advanced socially than one with a mental age of six; and the latter, in turn, more than the one with a mental age of four. However, the physical level of these children affects their status of social development also. If the six-year-old with a mental age of nine is advanced physically, then he is also more likely to be advanced socially than if he is average or below average in size or development. Similarly, a child of average mental status tends to be above or below average according to physical status, and children retarded mentally probably will be above their mental status socially if they are of good size.

Being off size tends to make it harder to adjust to people. A child who is exceptionally tall or heavy for his age usually may not be considered well-developed for his age, and such deviates often have emotional problems which cause them difficulty in fitting into the group. Children so handicapped are not mature enough to fit with individuals of their height or weight and do not fit with children of their own age. They are both overgrown and outgrown. Children that are undergrown physically, as a rule, fit better with younger children more nearly their own size, a fact that indicates that their social age is not up to their chronological age. A child who is well-developed physically, however, in the sense that he is above average for his age in both height and weight, is generally advanced socially and especially so if he has a good intellect. Physical and intellectual development are two important factors in determining the ability of a child to adjust to various social situations.

It can also be pointed out that the brighter larger boys engage in team games, whereas smaller boys and duller larger ones or groups made up of both have not reached that stage but play games requiring less organization. Comparably, some girls at the age of fifteen and sixteen are comparatively mature and experienced in situations involving members of the other sex, whereas others do not reach this stage until a number of years later. Some, in turn, never mature socially in this respect.

Mollie Ann was such a person. She had been raised in a farm home where she had little contact with other people and practically no social experience with boys and girls or young men and women of her own age. She became very backward in her relationships with people, and her attention centered on household duties and the less social church activities. Socially she was immature and passed through her twenties, thirties, and part of her forties with only slight and incidental acquaintanceship with men. In her middle forties, however, she had some attentions paid her by a man of her own age. She interpreted those attentions as promising marriage, and she became emotionally keyed up with hope. It may be said that she acted as an adolescent would, but for the fact that an adolescent would have been more rational and less seriously affected. The fact is that because she was middle-aged and found herself for the first time in what she interpreted to be a romantic situation, she was less mature socially than many girls less than half her age. Of course, it may be held that persons in love on either a real or an imaginary basis seem none too mature socially to the rational observer; but in all seriousness, it should be recognized that some manifest greater maturity in romantic situations than do others.

Mollie Ann responded no more wisely than does any titting old maid who, romantically speaking, sees what does not exist and has faith in that which she hoped for. Her supposed lover was no lover at all but only reasonably courteous and attentive. The romantic bubble burst when events over a period of summer months made it painfully clear that there was only one party to the romance, and Mollie Ann is back in her monotonous routine of life, more deadened because of the after-effects of her emotional intoxication.

#### CHRONOLOGICAL DEVELOPMENT OF SOME CHARACTERISTICS OF SOCIAL DEVELOPMENT

**Age and Social Level.**—It is difficult to analyze social development chronologically in the same way that physical or mental growth can be analyzed. Physically, there is growth from year to year which can be described by tables or depicted graphically showing growth in inches and pounds. Mental development can be represented by a curve showing mental growth from childhood to

adulthood. Social growth cannot be described in quantitative terms in all respects and can hardly be summarized in tables and curves. Data can be given on certain types of behavior such as delinquency, truancy, and play behavior; and probably in the future we may be able to express a person's social development as a social age comparable to our present mental age.

In the areas of social development where quantitative measurements have not been made, we make certain assumptions. We assume, for example, that a person who is courteous and mannerly in a social gathering, who can carry on an interesting conversation, manifests a higher order of social development than does a person shy and reclusive or one who is overly aggressive, boisterous, and otherwise offensive. Furthermore, the gracious and friendly adult is regarded as advanced socially over the young child who plays in a sandbox. It is assumed, with qualification, that various types of behavior are characteristic of various levels of social development. Much of this growth in behavior accompanies chronological development in a general way, and it is expected that the behavior of persons of a given age corresponds to that which is characteristic of those ages. One does not expect an adolescent girl to be "old and staid" or an old man to be a "cutup"; there are times when we say to children and adults, "be your age."

**Age and Development of Antisocial Behavior.**—Inconsistent with the assumption, if not the fact, that children mature socially as they become older, we have the evidence that antisocial behavior also increases with age up to a certain period in life, after which it decreases. Truancy may be considered a form of antisocial behavior, and it increases during the school years to reach a maximum for boys at the age of thirteen and fourteen. For girls, it reaches its highest point at the age of fifteen. In the case of both sexes, it may be concluded that truancy is most frequent among students in their early and middle teens.

Truancy is consistent with the characteristics of adolescents and is a symptom of their general attitude and behavior. Adolescents show a tendency to break away from control and authority. In relation to their home, they show the same inclination when they defy parental authority, stay away from home for longer periods than usual, and look for a job so that they can be independent. At this time, many wish to quit school and get a job.

Adolescents manifest in their manner of talk and in their walk that they feel able to take care of themselves in the world.

Evidence of the tendency for boys and girls fourteen, fifteen, and sixteen years old to break away from home is found in the smaller communities, particularly in their tendency to "go downtown" in the evening and in their desire to stay out comparatively late. In the larger communities, the boys and girls congregate on the playground or at a corner, restaurant, or recreational center. It is sometimes said of them that they go home when they have nowhere else to go. Such a statement applied to most boys and girls of adolescent age is an exaggeration, but it does suggest a weaning away from home ties.

During their teens, adolescents wean themselves from the many controls that, by necessity, have been previously exercised over them. Adolescence is a period when the individual makes the transition from childhood to adulthood. Of necessity, he must break away from many controls and assume a more independent role. A person who never does so remains infantile in many respects and does not grow up socially. But defying authority as expressed by truancy and more serious behavior is not a desirable way of breaking away from childhood and entering adulthood. The problem becomes one of guidance and control whereby the adolescent can make his readjustments and achieve more independence and still carry on in a way that will develop him most in a socially acceptable manner.

Not only is truancy prevalent during adolescence, but general delinquency also reaches alarming proportions during that period of life. It is difficult to pick any given age when offenders in greatest numbers first come to the attention of the authorities. The span of years, however, between twelve and eighteen includes the ages when delinquency reaches its height. Accordingly, anti-social behavior reaches a high point at the time of life when the transition is being made from childhood to adulthood, a period when social development should be rapid. Serious crime, however, does not have its greatest frequency in the teens but in the third decade of life. A common statement is to the effect that criminals are becoming younger than formerly and consequently the problem of social growth and control is becoming a more important problem of the school. There is considerable doubt as to whether criminals are becoming younger; nevertheless, the

school will always have a serious responsibility in the guidance of adolescent youth. A study of 509 criminal careers provides data on the age of first delinquency and of the first arrest in the case of boys and young men(1). Delinquency in this instance refers to conflict with social or legal authorities that is serious but does not result in an arrest. Table III shows the number and percentage of each age at the time of first delinquency and first arrest of a group that had been committed to a reformatory.

TABLE III.—AGE OF REFORMATORY GROUP AT FIRST KNOWN DELINQUENCY AND FIRST ARREST\*

| Age              | First delinquency |          | First arrest |          |
|------------------|-------------------|----------|--------------|----------|
|                  | Number            | Per cent | Number       | Per cent |
| 6 or under.....  | 4                 | 0.8      | 1            | 0.2      |
| 7 to 8.....      | 11                | 2.2      | 10           | 2.       |
| 9 to 10.....     | 36                | 7.1      | 34           | 6.7      |
| 11 to 12.....    | 86                | 16.9     | 76           | 14.9     |
| 13 to 14.....    | 139               | 27.2     | 91           | 17.8     |
| 15 to 16.....    | 117               | 23.      | 85           | 16.6     |
| 17 to 18.....    | 78                | 15.3     | 88           | 17.3     |
| 19 to 20.....    | 28                | 5.5      | 55           | 10.8     |
| 21 and over..... | 10                | 2.       | 69           | 13.7     |
| Total.....       | 509               | 100.     | 509          | 100.     |

\* Reprinted from *Criminal Careers*, by Sheldon and Eleanor T. Glueck, by permission of and special arrangement with Alfred A. Knopf, Inc., authorized publishers.

The ages of greatest delinquency in the case of boys are from eleven to eighteen, and arrests are also more frequent during these years. There is a tendency, of course, for arrests to follow delinquency by a short period at least, and the table indicates that fact by the relatively larger number of arrests than delinquencies during the late teens and twenties.

In the case of most crime, it will be found that a majority of those who are brought to court are young. About one-fourth of them have not reached voting age; approximately one-half are under twenty-five; and nearly three-fourths are under thirty. Investigators may differ some in their findings, but these statements are a good summary of the relationship of age to arrest and conviction for criminal activity. Crime is like genius and great promise; it is manifested in youth and in early adult life.



**Are Delinquents and Criminals Becoming Younger?**—An oft made statement is to the effect that antisocial behavior is becoming increasingly characteristic of younger persons. "Our criminals are becoming younger and younger." Like many oft repeated statements, this one is hardly true, either. Investigation indicates that between the years 1927 and 1934 inclusive, the number of boys and girls dealt with by the courts in proportion to the total number of boys and girls in the population has actually declined(2). In other words, the proportion of delinquents is actually decreasing. Antisocial behavior is still a very serious problem and will continue to be until it is reduced many times as much as that which appears to have been achieved at present.

**Sex Differences.**—Many more boys are delinquent and criminal than are girls and women. Members of the feminine sex are arrested and convicted for breaking the law only about one-twentieth as often as are boys and men. Some data indicate that girls are delinquent about one-eighth or one-tenth as often as are boys. Part of this apparent sex difference may be attributed to the tendency not to convict female offenders and send them to prison but to treat them outside prison. This type of extra-institutional treatment may indicate, however, that women are not so antisocial as men.

**Causes of Antisocial Behavior.**—A major cause of crime and delinquency is poverty. Boys and girls raised in poor homes, slums, or tenements often are driven to delinquency. Their deficient situation develops in them so many unsatisfied wants that it is not surprising that such a large proportion of antisocial behavior takes the form of stealing. Associated with poverty are discouragement, bad physical health, emotional problems, low moral standards, all of which encourage delinquency.

Also associated with poverty as a cause of antisocial behavior are the contradictions: child labor and unemployment of youth. When children are employed, we have an undesirable social situation, as is also the case when youth, old enough to work and desirous to do so, is unable to find positions. Some investigators in the field of delinquency estimate that as high as 90 per cent of difficulties experienced by youth are caused by unemployment. The facts are that there is very little undesirable behavior of a serious nature among young people who are busy attending school or are satisfactorily employed.

Parental laxity has been set forth as another reason, and the home has been accused of not maintaining its responsibility for the "proper upbringing" of children. It is generally admitted, and research tends to support the general belief, that parental control and the general environment of the home are a powerful influence on the behavior of children. Many delinquents and criminals come from broken and disrupted homes. Divorce, employment of the mother, and the death of one or both parents are associated definitely with a large degree of maladjustment of children reared in such homes. Divorce and employment of the mother may be symptoms of undesirable causal conditions such as poor personalities of the parents in the former case and poverty and low income in the latter. These conditions influence the children unfavorably.

Where municipalities have attacked delinquency and crime by supporting well-conducted recreational programs, they have been rewarded by a marked decline in delinquency. A decline of as high as 50 per cent is claimed in some instances. If a youth is interestingly employed, either vocationally or recreationally, he is less likely to fall into crime. Recreational programs are important, but we should recognize the more fundamental problems of improving the social and economic conditions that result in child labor and unemployment, working mothers, and low incomes. All conditions and factors, however, should be taken into account, as the causes of unsocial behavior are several, and some are closely related.

#### ADOLESCENCE AND SOCIAL MATURITY

Adolescence is a period that is very critical in terms of social adjustment and maturation. It is a period of great physical growth and development; and even though one of less mental growth, it is educationally vital. Comparatively, the teens are probably most important socially because such critical problems are faced at this time. Conceivably, the problems faced in adolescence have their roots in previous years and come to a head during the teens. It is often maintained that the source of our personal difficulties lies in poor training during the preschool period. It should be recognized as an incontrovertible fact that all years are important and that training and growth are major considerations at all times. Still, there are certain problems of

social adjustment that become acute during adolescence, and it will be of little avail to argue that they should have been cared for in early childhood. It is wisdom to anticipate problems and, as far as possible, pre-solve them, so to speak. Yet the problems appear in adolescence and must be met then. Brief reference has been made to this point before, but now it will be discussed in greater detail. One of the social problems facing adolescents and their parents is to wean themselves from each other. The achievement of gradual separation depends largely on the wisdom of the parents. Dependence on parents should be lessened, but many parents will not let go of their children. When a person approaches adulthood, it is desirable that he enlarge his environment and become more self-sufficient. The boy, for example, who is tied to his mother's apron strings is not only being poorly prepared for adulthood but is poorly adjusted during his childhood and pre-adult years.

Children naturally have a strong attachment for their parents and feel very dependent on them. It is desirable that filial relationships involve the finer sensibilities of parents and children, but the feeling of the children for their parents should not reach the point of being a strong complex. A relationship of this kind is called the *Oedipus complex*; usually the son has a very strong attachment to the mother, and the daughter for the father. Many other situations not so extreme make social adjustment difficult.

A child eventually reaches a stage when he must break many of the relationships that he has had with his parents. It is seldom that a young man or woman breaks away from his home all at once, only to come back for an infrequent visit of short duration. Instead, the adolescent, and sometimes the child, is away from home overnight or for several days. Visits of a few days away from home with friends and relatives are desirable. Some children have the opportunity to attend summer camps; graduates of high school go away to attend college; and, to some extent, boys and girls go away from home to attend high school.

Extreme homesickness indicates a failure to have prepared for an adjustment that must be made by everyone. If the social development of children and adolescents is to be adequate, they must be given considerable experience in being away from home. Naturally, it is hard for parents to face the fact that their children

are growing away from them, but they must realize that it is the process of life. No satisfactory social development can take place unless an individual is able effectively to enlarge his environment beyond that of his home.

Maladjustment is likely to occur in the case of a newly married couple if either or both the young husband or the young wife have not been weaned from their childhood homes. This is not intended to imply that children should not express all the proper sentiments toward their parental home, but the time must come, and especially in marriage, when a new home supplements the old one. The old joke about the new bride's "going home to mother" has its serious implications. A daughter or son whose social development has been wisely controlled will have the power to adjust happily in new situations and still to maintain loyalty toward the home of his childhood.

**The Opposite Sex.**—Up to the time of adolescence, the problems pertaining to the two sexes are comparatively simple. Younger children play together hardly conscious of each other's sex. During grade-school age, the awareness increases, and boys and girls of even the lower grades can be seen making a play for each other's attention. During the pre-adolescent years, the motive that plays a major part in girl-boy relationship is the desire for personal recognition. Boys and girls of the more immediate pre-adolescent years do not seek out each other's company. Boys generally play with boys, and girls with girls. During the preschool days, however, the sexes mix quite generally in their play; but during the years from six and up into the teens, the girls and boys in their play tend to segregate according to sex.

When adolescence is reached, the situation becomes different. The change shows itself in social ways. Adolescents enjoy mixed parties and dancing. In addition, the individual boy and girl seek each other out; it may be said that they pursue each other.

The trend in social interests that are evident in adolescence is caused in large measure by the organic and biological changes that take place. A reexamination of Fig. 2 will bring this point back to mind to those who may have forgotten. The problem of the relationships between boys and girls is particularly basic because these organic changes are accompanied by biological urges that need to be controlled. The problems will not be solved by segregating boys and girls of teen age. The fact is

that they themselves will prevent segregation; segregation can be accomplished effectively only in the case of deficient and delinquents when they are institutionalized.

Boys and girls seek each other's company, and the problem of the parents, teachers, recreational leaders, and others working with youth is to control them under circumstances that are most wholesome. Let them be together in the home, the school, and church activities, on the skating rink, or on the recreational field. Boys and girls, especially those of high-school and college age, are sure to come together; their meetings should be held under friendly, wholesome circumstances.

In fact, one of the finest outcomes of high-school and especially college education is the bringing of selected boys and girls together. Many of life's romances occur in college, and the resulting marriages are generally successful. Data indicate that relatively few marriages resulting from college romances end in divorce or show other symptoms of failure. Of course, it might be expected that college students would do better matrimonially because they are superior both mentally and socially. Still, the excellent circumstances in a college or university under which young men and women associate with each other are especially propitious to good mating. Because of the favorable history of such mating, it has been remarked, in connection with the statement about marriages' being made in heaven, that branch offices of heaven are to be found in the colleges and universities.

In summary, it should be said that a significant phase of social development pertains to the members of both sexes' learning to adjust to each other. As a problem, it becomes most important during adolescence and postadolescence or during the high-school and college years. A well-controlled program of extracurricular activities will probably be as effective in solving this problem as anything that can be done by the schools.

#### **MAKING AND KEEPING FRIENDS**

The extent to which a person makes and keeps friends indicates his ability to get along with people. Thus, this ability reflects a person's social intelligence. Much has been written on how to make friends, or the psychology of dealing with people. It does not fall within the province of a textbook in educational psychology to go into any great detail in the discussion of such techniques.

Perhaps it suffices to stress the importance of getting along with people as the most important part of social development.

There are some children and adults who seem to have the magic touch. Every contact that they make with others tends to translate a newly made acquaintanceship into friendship and old friends into firmer ones. In general, the major phase of the technique for making friends either natural or acquired is to make others feel happy about themselves. The socially successful cause others to have a feeling of personal worth. Obviously, there are many subtle techniques for the creation of good feeling. They cannot be discussed here, but it may be said that a person's social development can be measured by his power to adjust to other people.

Some persons, on the other hand, get along badly with people. They antagonize them in many ways by being intolerant, neglectful, unkind, and in general by behaving in ways that offend them. Some people boast of having made a certain person "feel small." In doing so, they have made an enemy and have shown that they have failed to get along with that person.

Failure to deal effectively with people is a symptom of poor social development and may be caused in large part by poor emotional control. For example, an individual with an acute inferiority complex will have difficulty in getting along with people. He is apt to be sensitive and show fits of temper. His expressions of compensation, or "plus gestures," are likely to be offensive to others.

Shyness is a reflection of various feelings and emotionalized attitudes which make social adjustment difficult. Because they stay in the background, shy persons do not make opportunities for themselves. They lack confidence and are so constituted that they retreat from people because they do not meet them well. The emotional factor is closely related to social development, as there is, to a considerable extent, a causal relationship existing between them.

Shyness could be overcome in the case of some individuals if they realized what their actual abilities really are. Some children have been conditioned by the circumstances of life to feel that they are unable to compete effectively with other children. Children of poor economic status, for example, are often influenced to be recessive, so to speak, by the larger house, newer car,

better clothes, and more spending money of other children and their parents.

When some of the less favored children realize that they are as good as most and superior to many of their classmates in academic and play abilities, they tend to overcome their shyness. When a child learns that he is as "good as the next one," he also changes his attitude toward others.

An effective way to overcome shyness and more generally to bring about better social development is to develop abilities in children. For example, if children can do tap or acrobatic dancing, play the piano or other instrument, draw and paint well, be successful in dramatic work, and have other accomplishments, they are not likely to be timid. Consequently, the development of abilities of children and adults is essential for good social development. The person who is well read and has traveled extensively is more likely, for example, to be a good conversationalist than one who has not had many stimulating experiences. Thus, the provision for enriching experiences and development of talents contributes to social growth and development.

#### THE FORMATION OF THE GANG

During the course of social development, an age is reached when boys, particularly, band themselves together into clubs and gangs. The formation of gangs does not occur among boys of all ages. Young boys under ten seldom band themselves into groups, teams, or gangs. Organized team play is characteristic of boys in the upper grades and high school. Schoolboys tend to merge into gangs from various unorganized play groups.

Gangs take various forms. In many instances, they are organized about athletic teams. For example, the North Side baseball team may be the nucleus for the North Side gang, and a boy scout troop in another area may be the core of a gang also. The playground and gymnasium may be their meeting place, although they often have their own shack, barn, or vacant lot.

The term *gang* has an unfavorable connotation because of the various gangs of desperados that have been headlined in our newspapers. The meaning of the term *gang* should not be restricted so that it connotes only crime and delinquency. Gangs may be both good and bad. As has been indicated, they may be organized for wholesome outdoor activities—play, camping, and

athletics—but they may be the outgrowth of groups organized for minor thievery, fighting, and vandalism. Names such as the “Dirty Dozen,” the “Gashouse Gang,” and the “Rats” imply antisocial behavior; and much adult crime has its antecedence in adolescent gang activity.

The principal purpose of the gang or similarly organized group is to seek adventure. The adolescent boy is restless and, because of his love of activity, seeks new and thrilling experiences. Stimulated by fellow members, thrills and excitement are obtained through group activity that could not be obtained individually. Attempts are made to redirect the gang tendency of boys into socially accepted activities. Organized athletic teams, various clubs, school police, boy scouts, etc., are promoted as desirable substitutes of gangs whose activities are antisocial. Because boys have a tendency to band together and manifest their love of group strength and desire for thrills, various social agencies are interested in utilizing this tendency by organizing boys and girls for wholesome and healthful projects.

Gangs have their leaders, and they are generally selected because of their superior abilities. If the gang is one the behavior of whose members is antisocial, the leader is usually the one who has the brains to plan for the gang and who is respected for his ability to fight. In athletic teams or clubs, the leader is generally the one who is the best player and can more or less successfully control the others. In short, the boy with the power of leadership is chosen to lead the organization.

**Disintegration of the Gang.**—There are also certain developments in the lives of boys which take place in the later teens and early twenties that cause most gangs and teams to disintegrate. The interest in the opposite sex, which develops in boys in their middle and particularly the later teens, causes many of them to divert their interest from the activities of the gang, club, or team to the members and, in particular, to a single member of the opposite sex. New interests thus supplant the ones associated with the activities of the gang. When a few members go to a show or dance with their “girls,” the ties that held the members of the gang together are weakened. Even baseball teams made up of young men in their late teens and early twenties are faced with the difficulty of keeping the team at regular practice and of maintaining the regular “line-up” because “dates” interfere.



Subsequent marriage brings on so many additional duties that relationships of a man with his former gang are almost completely broken.

The boy in his teens also develops a strong vocational motive, an interest not dissociated from the pattern of early adult development. He either obtains a job or seriously prepares for one. Because of his earnest search for economic security, he substitutes the security that he obtains in his work for the security that he obtained, to some degree, in the group activities of the gang. After leaving the gang, his interest and activities are more individualistic in nature.

Criminal gangs tend to be maintained longer than others. Some have members who are in their twenties and thirties, the circumstances that surround their behavior offsetting the forces that cause most gangs to disintegrate. The desperados who constitute these gangs probably had as their original motives the search for excitement and adventure; but after they have had several successes, they are held together by the economic motive by the discipline imposed by the leader, and by the necessity of trying to escape from the law. Partners in crime can hardly break away from each other but must carry through together until they are caught or exterminated. Circumstances that force their common fight against the law keep them united.

**The Gang Age.**—As has been stated, there is a rather definitely fixed age for gang, team, or organization. A recognition of that fact is found in the boy scout organization, which does not admit boys until they are twelve. A few years later, during adolescence, however, they tend to drop away from the scouts, not only because the activities are hardly adult enough but also because, as they grow older, other interests destroy the hold that such an organization has on them.

Boys of the gang age love books of adventure. They admire physical prowess, and their heroes are great hunters, great athletes, desperados, cowboys, and movie actors who play "he-man" roles. The boys themselves are becoming increasingly conscious of their own physical strength and muscular development. Naturally, they select as their ideals those who have great powers of this kind.

**The Pre-gang Age.**—During the ages of seven, eight, nine, and ten, little organization is evident in the play and activities of

children. The younger boys and girls play together with objects and things. Play equipment such as swings, sand tables, seesaws, slides, and merry-go-rounds are more interesting to children of this age than to older ones. Children of the lower grades play jacks and marbles, which are competitive in nature but involve only individual competition. The child plays for himself against one or more children and plays hard for his own individual score. When he is older, he will be organized in teams and work hard for the score of his team. Even in team games, the individual never loses sight of his own score and achievement.

**Adult Organizations.**—Organization into groups is not limited to youth. In adulthood, both men and women band themselves together in many ways for economic and social purposes. They organize into political parties, church organizations, fraternities, labor unions, orders, societies, federations, associations, and clubs, *ad infinitum*. In order to advance their interests and obtain security, adults make use of the principle "in union there is strength." People also organize for social purposes—there is hardly an adult who does not belong to a lodge or club. People were described in the older psychologies as having a gregarious instinct because of their tendency to be together. Certain springs of action such as the desire to obtain security and a feeling of personal worth also cause adults to organize. These organizations of adults have much in common with those of their youth.

#### RECREATIONAL ACTIVITY AND SOCIAL DEVELOPMENT

Certain types of activities have been associated with levels of development. Attempts have been made to characterize certain periods of life by particular kinds of behavior. The first four or five years of school age have been called the "big Injun" age. The group, team, or gang age has been associated with the teens, an age when the boys and girls become greatly interested in games and sports. Early childhood, or the first three years of life, has been called the imitative age; the individualistic, up to about six; after which a few years are competitive. The trend is toward an interest in socializing activities.

There are many classifications of this order that aim to describe various chronological portions of life according to play and recreational activities. In a very general way, they may be useful

because such classifications center attention on the level of social development; on the other hand, there is a great deal of unreliability in chronological classification of human interests and activity, because there are no hard-and-fast characteristics of given ages of childhood and youth. Studies of the play and activities of youth and childhood show that even though there are differences with age, still, some interests and activities extend over almost the full span of life.

No definite periods of life can be assigned to the love of sight-seeing, dancing, hunting, collecting, and playing outdoor games like baseball, tennis, and golf. People old and young, for example, like to dance; and the same holds true for many outdoor games. During early childhood, the reason that children do not play tennis, golf, and baseball is because they have not reached a level of physical development sufficient for acquiring the necessary skill; and when a person is too old, he has not the strength or endurance for some games. Hunting, collecting, and games like golf are engaged in by persons who cover a very wide age range; football, on the other hand, is played by boys and men of a comparatively restricted age. Interest in the game, however, covers most of the years of life.

There are changes in interest and activities, it is true; and activities like playing dolls and making mud pies are left behind by most children when they become older, although a few children continue them for a surprisingly long time. Instead of fixed periods, then, there is a gradual change and transition from year to year. This means that from year to year there is a change in the interest and activities of children, with some individual children showing considerable change and others comparatively little. All children of a given age are far from being alike—some being more mature, so to speak, than others, and some being relatively immature. There are as great differences in the social maturity of children of a given age as there are differences in mental, physical, and emotional maturity, even though the correlation of these different kinds of development is not very high. In other words, the child having high mental maturity may not have correspondingly high social, physical, and emotional development, although he is likely to be above the average and may be correspondingly high; similarly for the correspondence at all other levels of the various kinds of maturity.

**Age and Play Activities.**—Even though there are strong threads of play and game interests that reach throughout much of life, there are gradual increases and wanings of several interests, so that some game and play activities are more characteristic of one age than of another. Lehmann and Witty have analyzed the trend in the game and play activities over an age range from eight to twenty-two and in some instances among older adults(3). They found that there are definite trends with age, even though the interest in some activities changes very little during the period of childhood and youth. For instance, reading the Sunday "funnies" is a common and one of the most frequent activities for boys up to fifteen and also between sixteen and twenty-two although not quite so frequent for the older group. For girls, this is a common one also; but for those twenty years and older, the interest has weakened materially. There is a sex difference in this activity among the older boys and girls, with the girls being less interested. Activity in running races and random running and jumping declines with age, whereas watching athletic sports, going to movies, and engaging in sports like football, baseball, and basketball increases with age in the case of boys. For the girls, there is a decline in activity, from the early school and following years, in the cutting of paper with scissors, playing with dolls, playing house, and skipping rope and an increased activity in going to the movies, reading the newspapers, hiking, and social dancing.

Boys of all ages like football, baseball, and basketball best, a probably insignificant change in interest occurring with age. Basketball, for example, is ranked slightly higher by boys in their teens than by younger boys, who prefer football. Younger girls of the pre- and early teens like roller skating, playing with dolls, reading books, and going to the movies, whereas later teens and early twenties like dancing, having dates, reading books, and going to the movies. These trends reflect definite social development, probably more in the case of the girls, although the boys like team games best, a taste that is an indication of social growth.

Social development is also shown by the proportion of children of each age that participate in certain activities. Boys under ten engage more than do others in playing in the sand, spinning tops, coasting, and playing Indian; boys under fourteen like running,

jumping, and climbing best. The late teens show greater interest in "dates," parties, picnics, and dancing. In fact, this pattern of activity is quite characteristic of both sexes.

There are literally hundreds of games and activities in which boys and girls of all ages can participate, and still comparatively few make up the bulk of all of those engaged in by children and adults also. Younger children engage in the greatest number, and the older in the fewest. Then, as usual, there is great variation for each age group, some individual children being much more active than others.

### SUMMARY

There is a relationship between social maturity and physical and mental ages. The child who is more advanced physically and mentally for his chronological age tends to be more advanced socially, whereas the opposite is true of children whose physical and mental development is under the average for his chronological age. There are exceptions, of course, but that is the general trend. In a general way, there is a type of average social behavior that is more or less customary and traditional for various age levels. There is also, on the whole, an improvement with age in courtesy and friendliness.

Still, for some persons, especially boys, there is a decided increase in unsocial and antisocial behavior throughout the junior and senior high-school years. A characteristic of adolescent youth, especially boys, is a mild rebellion which expresses itself in a new independence and which, for some, takes the serious form of defying authority, regulations, and even the law. In the case of delinquency of boys, from eleven to eighteen are the years of greatest violations. For crime, however, the ages are older, with only one-fourth of those being brought to the court under twenty-one, and nearly three-fourths under thirty. Fortunately, the tendency is not for the criminals to be younger than formerly. Girls are much less antisocial than boys, being delinquent only about one-tenth as much.

Antisocial behavior has many causes—poverty, ill health, unemployment, ineffective parents, broken homes, and lack of recreational facilities.

During adolescence, the problem of social adjustment is particularly critical because of the many forces, both internal, or

physiological, and external, or social, that influence the adolescent. At this time of life, he is faced with the problem of weaning himself away from his parents and assuming the responsibility for his own economic security. During their teens, boys and girls reach the stage of physiological development that causes them to have a heightened interest in each other, and in this situation lie many serious problems.

As a child grows older, his capacity for friendship can be developed. Some boys and girls become unfortunately more unsocial, while others develop the capacity for adjustment. A major problem of the school is to control circumstances so that the individual student will learn how to get along with people.

The gang represents a stage of social development. It does not take form until the ages of eleven or twelve; before that, we have the so called *pre-gang age*, during which there is little organization. Characteristic of the gang age is that boys club together for play and excitement, and possibly the underlying motive is the quest for security. Among adults, the organization of groups is so common that there is hardly an adult who does not belong to one or more organizations. The gang tends to disintegrate when the boys reach an age where their interest in girls and in a vocation causes them to have more individual than group interest.

Throughout practically all of life, human beings have an interest in play and recreational activity. Interest in games and play, however, varies according to age, some distinct interests occurring in early childhood, later childhood, early adulthood, and later adulthood. Some activities tend to be individualistic; others are more of a group nature; certain threads of interest in play and recreation extend throughout life.

### Problems and Exercises

1. A boy six years old has the physical development of an average eight-year-old and a mental age of nine. Discuss what he is likely to be from the standpoint of social development. Similarly for a six-year-old boy with a physical age of five and a mental age of four.

2. Why is it important that children have considerable opportunity to be with people of various ages?

3. What should the schools do to insure the social growth of their pupils?

4. How can the tendency of many adolescent boys to break away from control in order to obtain their independence be controlled in order to avoid antisocial behavior?

5. There is a great incidence of delinquency during the junior and senior high-school years. What can the school do to reduce this large amount of maladjustment?

6. Enumerate and evaluate the various factors that cause delinquency and crime.

7. What adjustments must an adolescent make in his change from childhood to adulthood? How do you propose that the problem of boy-girl relationship be most successfully adjusted?

8. Discuss whether or not a person has few friends because he has little social intelligence or has made a poor social adjustment because he has few friends.

9. What are some of the characteristics of a person who is well adjusted socially? Poorly adjusted?

10. Explain how the gang activity of boys in their early teens represents a level of development above the activities of the pre-gang age.

11. How can the desire of boys to gang together be utilized for their best training?

12. Name some play and recreational activities that are characteristic of various age levels.

13. Name and describe interests and activities that extend over most of the years of life.

14. Discuss forms of behavior that you think are typical of a high order of social development and some that you think typify social immaturity.

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## CHAPTER IV

### EMOTIONS—THEIR SIGNIFICANCE AND PHYSICAL ASPECTS AND FACTORS THAT AFFECT THEM

**Directions for Study.**—In this chapter, reference is made to the practice that educators have of often overlooking the importance of children's feelings and emotions.

Note how the emotions influence personal adjustment as well as the ability of students to think and to learn.

The emotions and feelings are organically a part of the body, as they involve the organs and glands of the body and also the chemistry of the body.

Be able to give the organic or body elements in the emotions.

What do we mean by the endocrines, and what are their functions?

Various factors and situations are mentioned that influence emotional adjustment and maladjustment. In this connection, learn what effect too difficult and too easy work have.

How can a teacher influence the feelings and emotions of pupils favorably or unfavorably?

The group and its activities also affect the children, and another important factor that should be studied is the influences of the sexes on each other.

**Introduction.**—Many teachers, principals, and superintendents are so obsessed with "getting results" that they neglect the emotional life of the child. By getting results they mean pulling the pupils through the tests, getting them to pass state examinations, or making them surpass the city median on the standardized subject-matter tests. Results are measured in terms of achievement in these tests, and teaching methods are evaluated in terms of their effectiveness in preparing the pupils for examinations. A teacher is regarded as good if her pupils do well on the examinations and ineffective if her pupils do poorly. The standards are related to the subject matter rather than to the pupils.



It is true that, on the average, teachers who are the best subject-matter teachers are also the best teachers of pupils. Many, however, who are efficient in presenting subject matter, have a bad effect on the feelings and emotions of their pupils. Some drill masters can bring their classes up to standards and appear, therefore, to be good teachers; but their work is often done by unduly suppressing and subduing the pupils. There are, on the other hand, teachers who guide and control so poorly that the children become chaotic both scholastically and emotionally. The teacher's problem is to guide the child so that he will achieve up to his capacity and at the same time adjust himself well personally.

Of the two aims, the latter is far more important. They are, however, not separated, for the children who achieve well in school according to their capacity are generally better adjusted emotionally than are those who do not. Because of the emphasis placed on school achievement, pupils who do not meet the achievement minimum are, in a sense, maladjusted and therefore possibly distressed and unhappy. Methods of teaching and curricula and standards of achievement should be arranged so that all may be happily adjusted in school.

**The Importance of the Emotions.**—The emotions play a much more important part in a child's life than do the few extra facts that a pupil acquires because of the stress placed on subject matter. Overstressing examinations is poor psychology, because it may distort a child's personal and emotional development. ✓ Personality is closely related to emotions; in other words, our emotional life determines, to a considerable extent, our personality.

Emotions are an intrinsic part of human life. Our emotional states determine whether we are happy or sad, friendly or angry, confident or afraid. Emotions function to preserve our lives; however, on some occasions they make us less efficient. We are energized by emotions but also inhibited by them. The emotions accompanying pleasurable activity remove fatigue, whereas emotions of anger and distress cause us to be fatigued.

Specifically, when an individual is faced with danger such as an approaching car, a wild animal, or a falling tree, fear in some instances gives one unusual alertness and ability to escape, but it has the effect of temporarily paralyzing others. Similarly,

when some persons face a class or audience, emotions of fright render them ineffective, whereas others are stimulated by an audience. The thinking processes may be either inhibited or stimulated by the emotions. Some get "so mad" they "cannot think," but on other occasions their thinking is stimulated by heightened feeling.

The emotions are dominant factors in our lives. Human beings cannot be separated from them. Neither can they "bottle them up" and live healthy lives. A normal expression of the feelings and emotions is essential to good mental health. Occasionally, we must "blow off steam," so to speak. The value of recreation lies in the extent to which it favorably stimulates the emotions. Our holidays give people an opportunity to give vent to some of theirs. Without an opportunity, people would become severely maladjusted. By providing play, dramatics, singing, and similar activities, schools aim to stimulate emotional expression and also to train pupils to control their emotions.

Human beings are emotional rather than rational. Children do not live their arithmetic, geography, or language, but they do live their feelings. Their worries, dreads, anxieties, fears, and joys are always part of them. These constitute their disposition and temperament. All of us react to a situation largely according to the way that we feel about it. Our effectiveness in dealing with people depends largely on how we feel about them and how they feel about us. We may forget what a speaker said, but our emotional attitude toward him will remain for a long time. Similarly, we forget most of the facts and theories that we learned in school; but our likes and dislikes, which govern our behavior extensively, remain, in many instances, throughout life. It is, therefore, more important that a pupil leave a class with enthusiasm for a subject so that he will continue to study it than that he leave with a dull collection of facts. For example, it is infinitely better that he leave a literature class so enthusiastic about the subject that he will like good literature and consequently continue to read it than that he acquire some technical information on the origins and structure of certain literary gems.

A school can give children feelings of uncertainty, on the one hand, or an attitude of confidence, on the other. It can cause pupils to be worried and discouraged, or it can help them to be happy in their work. The emotions, feelings, and attitudes are

important in school from kindergarten through the graduate school; they are intensely significant throughout life.

A young woman who finished a teacher's training course criticized one of her teachers who had supervised her practice teaching by saying that this teacher destroyed her confidence. This prospective teacher was a good student and had natural talent for teaching; but a severe, tyrannical, and unsympathetic supervisor destroyed her confidence, which is one of the most important qualities that a beginning teacher can possess. The effect that the critic teacher had on this young woman's emotions far outweighed in importance the teaching tricks and devices that she probably had acquired through the supervision and criticisms. Evidently, the possible influence of the relationship between student and teacher does not cease with the early formative years of grade school or even of high school. At any point in the process of formal education, the teacher is in a position to affect the emotions of her students to their advantage or to their detriment.

In these preliminary paragraphs, we have been discussing in a general way the importance of the emotions, feelings, and attitudes. We have indicated that the emotional life of a person is more important to him than the academic subject matter or the other scholastic elements in his life. It is necessary, however, to describe the emotions and feelings more specifically and to give the physiological and psychological bases of the emotions. An understanding of such bases and of the interrelationship of the physiological and psychological will help us understand the effect of the emotions and feelings on behavior.

#### THE PHYSICAL ASPECTS OF THE EMOTIONS

Every day we see the physical expression of emotions. Laughter, fear, grief, rage, anxiety, and worry are accompanied by characteristic facial expressions. The body, too, expresses emotions. It is limp with laughter, rigid with fear, tense with rage. The musculature and posture reflect the emotional state, and the emotional states involve the whole body. All this is especially apparent when the emotions are intense.

Those physical accompaniments of an emotion which occur within the body are of greatest significance. There are within the body various ductless glands known as the *endocrine glands*,

which give off into the blood stream chemicals having marked physiological and emotional effects. Emotional stimulation, in turn, causes some of the endocrine glands to discharge into the blood stream an increased amount of their secretion. Thus there is a reciprocal relationship between the glands and the

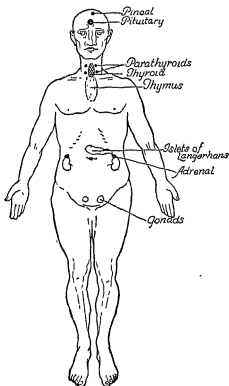


FIG. 4.—The location of some of the glands of internal secretion. (*J. P. Williams, Personal Hygiene Applied, 1934, p. 326. Courtesy of W. B. Saunders Company.*)

emotions. We do not see and only seldom sense the function of the glands, but they are inextricably involved with our health, emotions, and behavior.

**The Endocrine Glands.**—Figure 4 shows the location of the endocrine glands. They are also referred to as *ductless glands* and *glands of internal secretion*. The importance and function of each of these glands will be briefly described. Their relation-

ship to the emotions concerns us most, of course; but their wider function will help us to understand growth and behavior in general.

*The Thyroid Gland.*—The thyroid is located below the pharynx or in the lower front of the neck. Like other ductless glands, it secretes a chemical substance, or hormone, into the circulating blood. The thyroid hormone, thyroxin, contains 65 per cent of iodine. This hormone affects various organs in the body and is essential for growth. If a child is born with a thyroid that secretes an insufficient amount of thyroxin, he will not grow normally. He is known as a *cretin*. His face and body grow out of proportion to his legs, and he appears bulky of head and body. The child with thyroid deficiency differs from other children in physical appearance, but the most significant difference is the mental one. Cretins are feeble-minded. If, however, cretinism is discovered in infancy, thyroid extract, prepared from the glands of sheep, can be given, which will make up for the thyroid deficiency, and the child will grow normally and be relatively much brighter. The extract must be taken continually; otherwise, the child will resume cretin characteristics.

A person whose thyroid does not secrete enough thyroxin to maintain proper chemical balance of the body is said to be hypothyroid. The prefix *hypo-* means of less quantity, or low degree. We have indicated that a hypothyroid child is known as a cretin. Hypothyroidism also appears in adults and is then known as *myxedema*. An adult who is hypothyroid generally becomes heavy and bulky, dulls a little intellectually, and emotionally tends to be stolid and unresponsive; he gains weight because the thyroxin affects metabolism. In other words, when there is a deficiency of thyroxin, the food is not burned up for energy but adds to the body weight.

The opposite of hypothyroidism is hyperthyroidism. A person is hyperthyroid if his thyroid gives off too much of the thyroid hormone. The excess of thyroxin in the blood causes the food that he eats to be burned up to produce energy; consequently, the person who is hyperthyroid tends to be thin. He is generally high-strung, nervous, and easily upset emotionally; his heart rate is above normal. It is often necessary to remove part of the thyroid so that the amount of thyroxin secreted into the blood will be greatly reduced.

Both the condition of the thyroid designated as hypothyroidism and that designated as hyperthyroidism are known as *goiter*. The type of goiter associated with hypothyroidism is most common in the north central states because of a deficiency of iodine in the typical diet of people living in that area. To make up for the natural deficiency, a small percentage of iodides has been added to the salt used by people in this region. Oysters, crabs, shrimp, lobsters, and other sea foods contain a plentiful supply of iodine.

The goiter associated with hyperthyroidism generally requires a surgical operation. But rest and tranquil living will help allay the hyper condition if it is not too pronounced. Worry and strain, on the other hand, aggravate it.

*Adrenals.*—The adrenals are located just above the kidneys. They give off a hormone called *adrenalin*, which stimulates the release of sugar from the liver. The adrenalin provides energy by releasing the sugar and also by stimulating the heart action. During periods of strong emotion, the adrenals give off more adrenalin, just as they do when one is engaged in an active sport like tennis. If emotion is very intense and prolonged over a long period, a hysterical condition may develop.

The relationship of emotion to the adrenals may explain why a person sometimes accomplishes in a period of great emotional stress more than he has ever done before. At such a time, an individual may have run faster than he has ever run before, delivered a killing blow, or manifested a strength he had never been known to have. He surpassed his normal achievement because at a moment of intense emotion the adrenal secreted a large amount of adrenalin which in turn released a large amount of energy and so stimulated the heart that he was able to do more than he had done before.

We know also that emotional states affect the essential bodily functions. A person in a high state of excitement finds that he cannot eat; if he is worried and anxious, he does not have his normal appetite. If he becomes upset while eating, his digestive processes are disturbed. We recognize the importance of psychological conditions at mealtime for children when we try to have the conditions that surround mealtime happy and restful.

Emotions and feelings involve the whole organism: the endocrine glands; the tone of the muscles; and the digestive, circula-



tory, and respiratory systems. The degree to which the organism is affected or involved depends on the intensity of the emotion. This nature of emotions may help us to understand "nervous breakdowns." We generally say that a person overworked and had a nervous breakdown. The physical and mental effect of successful work is generally one of exhilaration, so it is likely that the person broke down because of the emotional or nervous states that accompanied the work. Breakdowns are seldom caused by hard work but more frequently by worry, anxiety, fear, and discouragement. The physical and mental effects of these emotional tensions are injurious, cause the breaking down of behavior patterns, and induce ill health. It is not the fatigue of work, but the "poisons" of unhappy emotions and feelings that have the deleterious effect.

*Islands of Langerhans.*—This is the part of the pancreas that produces an internal secretion known as *insulin*. The relations of insulin to the emotions and feeling are not known, nor the effect of emotional experience on the amount of insulin secreted.

Insulin is a chemical that controls the metabolism of the blood sugar. When the islands of Langerhans do not secrete enough insulin to control the blood sugar, a disease known as *diabetes* results. A person suffering from diabetes will be relieved by taking insulin that has been chemically prepared for diabetics. Metabolism is balanced, and the diabetic remains much improved as long as he takes the insulin.

*The Sex Glands.*—The male sex glands are known as the *testes*, and the female sex glands as the *ovaries*. Their secretions are both internal and external. It will suffice here to point out the general effect of these glands without going into much detail. They are important in the growth and development of the characteristics that differentiate the male from the female. If the sex glands are removed in the young male, thus destroying the effect of its hormone, the male tends to get fat and does not acquire a typical male body. A masculine voice does not develop, and there will be little or no growth of hair on the body and face. Girls, on the other hand, if deprived of the internal secretion of the sex glands, because of atrophy or operation, tend toward the masculine in body structure. Hair appears on the face, and the voice becomes deeper. These characteristics involving the voice,

body structure and growth, and distribution of hair are referred to as secondary sex characters.

Far more than almost anyone imagines, the sex glands are responsible for urges and interests causing emotional states that control human behavior. The effect of the sex glands on emotions, personality, and behavior becomes especially significant when puberty is reached. The interest of adolescent boys and girls in each other raises more problems of adjustment than do any other relationships. The sex drive, or instinct, with the exception of the instinct to live and be secure, is the most dominant of human forces. The core of interest in most movies and novels, in many games and activities, and, above all, in people lies in emotional elements that have a definite physiological basis.

*Pituitary.*—The pituitary gland is located at the base of the brain. One should not be misled by Fig. 4, which gives only the front view. The pituitary gives off a chemical substance that stimulates growth. People who are abnormally small, like the Tom Thumbs, have underactive pituitaries, whereas giants, seven- and eight-footers, have hyperactive pituitaries. The connection of the pituitary to the emotions is not known, although some relationship may exist.

Two other glands, the pineal and the thymus, can also be located on Fig. 4. The pineal is in the middle of the brain, and the thymus is under the thyroid. Although little or nothing is known about them, it is suspected that they influence body growth and sexual development. It is enough to mention them in passing and recognize the fact that they exist, but nothing definite can be attributed to them as yet.

*The Endocrines and Human Behavior.*—The endocrine glands seem to function together and for similar purposes. For example, the secretions of the pituitary, pineal, thyroid, and sex glands control growth very definitely. Furthermore, the thyroid, islands of Langerhans, and adrenals influence metabolism and the use of food taken into the body. The endocrines appear to be a complex interdependent system for maintaining the chemical balance of the body. Growth and health are dependent on them; our mental and emotional lives are both cause and effect of their function. If these glands function normally, we are likely to be well and happy; and also if our emotional life is a happy one, the psychic effects on the endocrines will be favorable.



We cannot be certain just how the feelings and the endocrine glands are related. We do know that there is an interrelationship that affects the chemistry of the body and also the behavior of the individual. Feelings and emotions are not transitory and superficial but are literally deep-seated in the body; consequently, attitudes based on them govern behavior more than do external rules and regulations.

The teacher should be aware of the relation between the emotions and their various bodily manifestations. She should use this knowledge not only to direct and understand the behavior of her pupils but also to govern and appreciate the importance of the emotions in herself and their possible effect on her own happiness and the happiness of her pupils.

#### CAUSES OF EMOTIONAL ADJUSTMENT AND MALADJUSTMENT

Certain school conditions make children happy and satisfied; others make them unhappy. A discussion of some school situations will make us conscious of the factors and conditions that affect the emotional life of children.

**The Work Is Too Hard.**—More children become maladjusted because they cannot do the work than from any other cause. A child who frequently fails develops the attitude of one who is frustrated by obstacles. At first, he may become angry, then discouraged, and finally may develop a dread for the situation that so consistently defeats him. Such a child will turn from his work and find satisfaction in other activities, generally those not provided for in the school curriculum.

When a teacher asked a boy why he did so many silly things, he said, "I can't get geography. I try and try. First I get warm, then I get hot, and everything busts open."

Here was a pupil—and there are hundreds and thousands like him—who was frustrated because the school work was too hard for him. Since it caused only unhappy emotions, he turned to misbehavior for his compensation. It is the nature of human beings to turn from the unpleasant and try to find the pleasant. Continued failure in school subjects has the same effect as continued defeat in other activities. It causes distortion of the personality, driving the pupil to antisocial behavior.

The effect of failure is apparent at all school levels. Failure has its psychological effects on college students as well as on

pupils in the primary grades. Most college boys and girls who fail soon show the effects. Failure may be doubly hard on many of them because it comes to them as a shocking surprise. Nearly all college students did well enough in grade school, and most of them did satisfactorily in high school. Consequently, failure in college destroys an attitude of confidence and instills a feeling of inferiority.

The effect of failure was impressed on the writer when a student, after failing a course for the third time, called upon him for an explanation. There was no question about his failure, as his achievement was below the standard for passing, but neither was there any question about the harmful effect that his failure had had on him. When the student thought of himself, he was depressed emotionally, felt that he was inferior, and felt that he could not succeed at anything. When he spoke of his instructors, however, he was bitter and vindictive. He thought that his fellow students had not been so frank and honest with the instructors as he, that his classmates had been "apple polishers," who therefore got good marks. His college experience had made him so disagreeable that one wondered how long he would have to be in a friendly environment before he would acquire an agreeable personality or if the bodily and physiological effects of his past emotional life, the effects of his failures and their subsequent bitterness, were beyond correction. One can be certain that there were internal bodily effects and that the visceral "memory" of those emotions would far outlast the memory for the various facts that he had acquired in the course.

The emotional effects of this course will affect the behavior of this particular college student infinitely more than the factual instruction that he would have received had he been able to achieve above the minimum required for passing. All through this boy's life, certain events and particular associations will reinstate his experiences in college and the accompanying emotional states. Unless this boy makes a successful and happy adjustment in life and thus overcomes the emotional effects of his scholastic experiences, the emotional states that he developed in college will return periodically to harass him and cause distortions in his personality.

In school and in adult life, individuals should be guided into circumstances and situations where they can be successful. A

person of little capacity will be happy doing simple routine tasks, whereas a brilliant person is unhappy unless he is in a complex situation. Many a pupil has no capacity for the academic, and the school should devote itself to developing his personality rather than distort it by trying to crush the pupil of low academic ability into an academic mold. Pupils unequipped for academic work may be guided into types of activities more suitable to them.

**School Work May Be Too Easy.**—Very bright children, too, can become maladjusted if the school tries to fit them into a common mold. We often overlook the fact that school tasks may be too easy for some pupils. It is comparatively simple for the teacher to discern the maladjustments resulting from the inability of the pupil to do the work, but it is harder to analyze those caused by the work's being too easy. Maladjustment often results for boys and girls who learn their lessons with only a little preparation. If it takes only a little preparation, the pupil often does less. He is bored by drill and by repeated explanations of material that he understood when it was first explained. He loses interest and either crawls into his shell or turns to overt behavior which soon causes him to be classified as a behavior problem. Perhaps no student does his best unless called upon occasionally to do a little more than he can.

Harold was a boy like this. He had an I.Q. that placed him in the brightest 0.25 per cent of unselected children. On the average, he was the brightest child in 400. Still he was a failure in school according to the usual standards. He did not recite effectively; his written lessons were incomplete or fragmentary; and he took no interest in what went on in class. He received low marks and just managed to pass each year. Following a language lesson in which he had failed to answer the teacher's questions about declarative, exclamatory, and interrogative sentences, he defined and explained them perfectly. When asked why he had not done so in class, he replied, "This is the third time in my school experience that we have been asked to define the different kinds of sentences. I could do it the first time, and I see no point in doing it again."

School for him should not have been only a place where he was called on to answer questions that the teacher asked. It might have been a place to find the answers to questions that he wished to ask. Possibly if teachers would set up situations that

would stimulate their pupils to ask questions, the bright pupils, especially, would show more interest.

**All Success and No Failure.**—There are those who hold that a child should always be successful and that there should be no failure in anything that the child undertakes. Obviously, it is impossible to control the situation in which a child finds himself so that he will never taste failure. Secondly, it would be undesirable even if it could be done. A person maintains the best emotional balance toward his work and play if occasionally he feels defeat and grapples with a problem for which he cannot find the answer. The game of life is not worth while if it is too easy, and it is avoided if it is too hard. In either case, it does not bring out the best efforts. Easy success dulls the efforts, but success that crowns earnest effort has an emotional accompaniment of satisfaction that conditions one to work harder.

**The Teacher and the Emotions of the Children.**—The teacher is the most important factor in the lives of children when they are in school. She can help her children be courageous and confident, or she can make them servile and full of fears. She can cause them to develop a friendly attitude toward learning, or she may condition them so that they hate trying to learn anything. A teacher who dislikes her work soon infects her children with the same feeling toward their work.

A teacher may be a good teacher of subject matter but neglectful of the feelings and attitudes of her pupils. For instance, Miss M. was considered by her principal a good eighth-grade teacher. She made her assignments well, explained difficulties clearly, and seldom permitted a child to escape from preparing the assignments. She was a rigid disciplinarian, stern and sharp, and there was never any disorder in her room. A definite classroom procedure was maintained, and no deviation from it was allowed.

The children did not like Miss M., for they were afraid of her. They sat uneasy in their seats and were glad when the dismissal bell rang, although they did not dare show it. The older boys commonly quit school in her grade before the end of the school year. Parents noticed that their children, especially their daughters, were unduly worried and distressed about their lessons when they were in Miss M.'s room; they were more nervous in her grade than in others. Some parents said that they had to

expect that during the children's early teens; others, however, felt that Miss M.'s personality had a bad effect on their children.

There is a valid reason for considering some traits most desirable for a teacher. Rating scales, for example, include such qualities as patience, sympathy, humor, love for children, and friendliness. A teacher with those qualities is most likely to develop the personalities of her pupils, cause them to be in good emotional states, and minimize their behavior-problem tendencies.

It is said that teachers should teach children and not subjects. They must do both. Good education is not a matter of the one or the other. A teacher can be so dominated by a desire to teach the subject-matter content that she does not sense what she and her methods are doing to the feelings and attitude of the children. On the other hand, the teacher can be excellent in the sense that the children acquire skills and knowledge and also develop well emotionally. She can be skillful not only in developing the children's ability to get along with others, to overcome their fears, and to be happy but also in teaching the subject matter. In practice, subject-matter teaching and child teaching can go hand in hand; and it is more usual that a teacher is successful in both than in one alone. One can be distrustful of an educational situation in which, figuratively, the pupils are on one side of the desk and the teacher on the other. If children feel that the school situations are fair and impartial, that working diligently is worth while and satisfying, and that the teacher is their friend rather than a taskmaster, one may be reasonably sure that they are in a good environment.

**Emotional Reactions to a Group.**—Some children feel shy when they are in a group of children. They are uneasy and do not fall into the group activities without feeling self-conscious. Such children have feelings of inferiority and are not very happy when playing games or engaged in competitive play. They should not be rudely coerced to "jump in and play" but should be tactfully inducted into group activities.

A child who is small for his age and cannot compete on equal terms with his fellows is likely to develop feelings of inferiority. Therefore, he avoids games and activities in which he is thrown into competition with others and is unhappy in a situation where a rating of each child's ability is known. Such a child may be conditioned against play and avoid it altogether. He may

develop boisterousness or become tricky and shy in order to make up for his inability to play on even terms with his fellows. His most natural tendency will be to go off by himself or with one or two others.

The effect that ranking the players or members of a group may have on their interest in play is shown in the case of a group of children who played volley ball regularly. The members of the group were divided into sides; and when others came, they took sides so that the number on each side was equal. They played this way for a long time; but later they began choosing, always choosing the best players first and leaving the same children for the last choices. Those chosen last realized their classification quite clearly. When they were scheduled to play another team, only the best ones were chosen, leaving out a considerable number. The result was that the children who were regarded as poorer began to lose interest in playing volley ball and did not appear for play at the usual time. It was not long before so many children were conditioned against playing volley ball that the game died out for this group. If instead of laying stress on the comparative excellence of the players, the teams had been interested in making all of them feel necessary; or if they had emphasized the game rather than the score, the value of their group activity would have been much extended.

The behavior of children at a party or in a game offers a favorable opportunity for the teacher to study them and help them make a good adjustment. Those who act shy and seem reserved or who try to attract attention by being noisy or who want to go off by themselves are behaving in a manner that only conditions them to further maladjustment. The teacher who is patient and sympathetic, who possibly joins the play of the group, bringing these children into the game and guiding them, can maneuver them into the group activity so that the true fun of group play will take the place of the other feelings. The method is not to talk to the child about his shyness, secretiveness, or boisterousness but to guide him into situations that evoke feelings of exhilaration and happiness.

**The Opposite Sex.**—The child who is not at ease with members of the opposite sex is probably also experiencing emotions that are not conducive to a happy adjustment. Generally, when boys

and girls reach their teens they become more conscious of each other, and that consciousness is often accompanied by emotional tensions that cause aberrations in behavior. The problems can be alleviated a good deal if in the classroom the teacher merely takes it for granted that boys and girls talk together, that they help each other with their lessons and projects, and if she ignores the slight silliness that often manifests itself between the boys and girls but instead brings them together in their work and play so that they are less conscious of each other's sex.

Games and parties in which boys and girls are brought together frequently and under supervision will probably do more to adjust them to each other than any other means. It is essential that the games and parties be attractive and that children who attend them have more fun there than they could elsewhere. Teachers and others who act as chaperons should be friendly and join in the festivities.

A teacher whom the boys and girls regard as a "good sport" can do more to help them with their problems than can teachers and other adults whose characteristics, often classified as dignity, repel the students. The deficiency of our deans of women and deans of men, the former particularly, is that they are so cold and formal that the boys and girls will not give them a chance to help them. Students learn to regard advisors and deans as persons who are trying to catch them and whom they have to see when they are in trouble. The teacher should study her children from the point of view of their feelings and emotions. She should ask herself what effect her personality has on the children. A little praise might help one child, a friendly remark another, and possibly a mild reprimand another. Examination of each child's adjustment should hardly be begun without observing how he gets along with his fellows, whether he makes friends, plays well, or is ill at ease with others; also whether or not his lessons cause him to feel emotional stress. If any children are shy, secretive, and underhanded, she had better be doubly concerned about them and make special effort to become their friend and confidant. More time should be spent by a teacher in studying the feelings, attitudes, and behavior of her children than in examining her pupils to discover how many facts and rules they have learned.

## SUMMARY

Educators may fall into the error of considering only the learning of the child as it pertains to subject matter and overlook his feelings, emotions, and personal adjustment. In doing so, they overlook the tremendous significance of the feelings and emotions that a person experiences every minute of his life. Even in connection with the school subject, the attitude and feeling of a learner toward his subject is probably as important as what he has learned. In fact, it influences his learning to a marked degree.

The emotions are really part and parcel of the body, its tissues, organs, and endocrine glands. The glands that give off chemicals into the body and influence growth and feeling and in turn are influenced by feeling and emotion are the thyroid, adrenals, islands of Langerhans, sex glands, and pituitary. These influence human behavior and of course also influence general health and bodily growth.

School conditions influence the emotional adjustment and maladjustment of the pupils. If the work is too difficult, the child is frustrated and defeated. As a consequence, he develops a dislike for the subject, loses confidence, and acquires feelings of inferiority. Continued failure may influence the attitudes and behavior of children throughout their whole life.

But the work should not be too easy, because then it causes boredom and indifference. The student loses interest and often turns to mischief. It should be neither too hard nor too easy, and most of the time the child should be successful, but occasionally he needs the stimulation of very difficult work.

Some teachers instill interest and appreciation for their work; others cause their students to worry, to feel distressed, and to be afraid. Good teaching consists of first of all adjusting a child emotionally and then teaching effectively so that he develops educationally and mentally.

The reaction of the individual to a group is often a good index to his emotional adjustment. If he plays with avidity and enjoys the game, he is well adjusted; on the other hand, if he is shy and shuns competition, the likelihood is that his emotions are not healthful. In the same way, boys and girls should be able to adjust to each other. Overself-consciousness or inability to



carry on a conversation or play with each other is evidence of emotional immaturity. One of the major aims of the school is so to adjust the child to his environment that he will be happy and confident.

### Problems and Exercises

1. Give an example of a school situation where the concern is about the teaching of facts and information to the exclusion of an understanding or consideration of the emotional adjustment and development of the students.
2. Have you observed that when you are extremely excited or very angry you lose your appetite or do not digest your food well? What does this indicate about the physiological basis of the emotions?
3. Illustrate how our feelings and emotions influence our thinking.
4. Name a number of endocrine glands, and explain how they function.
5. What likely connections do some of these glands have with our feelings and emotions?
6. Describe how it is possible for worry, anger, and other stresses and strains to bring on illness.
7. Why is the dull child in school likely to become emotionally maladjusted? Explain whether or not the bright child, too, may have difficulty in making a satisfactory adjustment in grade and high school.
8. Recall your favorite teacher, and note whether or not his strength lay in his influence on the feelings and emotions of his pupils.
9. What can be done to bring a shy and retiring child into the activities of a group?
10. Comment on the statement that boys and girls of the teen age who get along with each other are probably well adjusted emotionally.

## CHAPTER V

### FEELINGS, EMOTIONS, AND PERSONAL ADJUSTMENT

**Directions for Study.**—Note the desire of persons to have a feeling of personal worth brought out by recognition of various kinds.

Observe the various factors that give people a feeling of personal worth and those which tend not to.

A number of factors and mechanisms are discussed that are the results of feelings and emotions. These are complexes, repressions, conflicts, daydreaming, rationalization, compensation, and worry. Observe how complexes are developed, how they interfere with mental efficiency, and also how one may overcome their injurious influences.

Study carefully what is meant by *repression*, and comprehend its unhealthful effects.

The term *conflict* is consistent with its usual meaning, but observe that the conflict is within the individual among various psychological forces.

Why are some children more given to daydreaming than others?

Various forms of rationalization are given that should be carefully studied.

Study the meaning of the term *compensation*, and be able to give some illustrations.

Distinguish between desirable worry and excessive worry.

Show how illness can be developed merely to satisfy the person who becomes sick.

How should temper tantrums be handled?

Classify the various forms of behavior, which have been given, as escape or defense mechanisms.

**Reality and a Feeling of Personal Worth.**—The most important person to almost everyone is himself. All of us, as children or adults, think in terms of ourselves. Each person, or self, wants to be an individual who is thought well of and who is important; every one of us wants to have a feeling of personal worth. We

dislike conditions and people that minimize us; we like applause, complimentary remarks, success, medals, gold stars, and whatever else makes us feel that we have worth. Recognition of our value stimulates in us pleasant feelings which condition our behavior probably as much as any other factor conditions it. Lack of recognition also causes emotions that often lead to negative and even vindictive reactions. It is said that a presidential candidate lost the election because he failed, when he entered a state, to confer with a senator who expected to be recognized by the candidate.

Much of the success of teachers, salesmen, and statesmen depends on increasing the feeling of personal worth of those with whom they come in contact. He who minimizes the sincerity, effort, and intelligence of those with whom he deals is sure to make bitter enemies. The teacher who treats his pupils as if they were not worthy of his attention will soon discover that they will react in a manner that will require more effort and skill than he possesses. Children and adults are so constituted that they demand recognition as being "somebody"—they want to feel that they have personal worth.

Thus, if a child learns slowly and is in a class where the lessons are too hard for him, the schoolroom situation defeats him so often that he begins to feel inferior. His feelings about himself are incompatible with those which one likes to have, of being capable and strong. Most individuals will not remain docile in such situations but will turn to forms of behavior socially unacceptable in order to gain favorable recognition and restore their sense of importance.

Furthermore, the child's home background may be poor and meager. His clothes may appear poor compared with those of some of the other children. The lunch that he brings to school may be so scanty that he goes off by himself in a corner to eat it. Other children proudly take pieces of chicken out of their baskets and display big red apples and large oranges. They feel well satisfied, whereas those who have only the barest sandwiches feel otherwise. These items may appear insignificant, but they are most important in terms of the emotions and feelings of children.

One of the worst consequences of depressions or periods of hard times is the effect that they have on the emotions of chil-

dren. Teachers have reported that during such periods children who had been happy and buoyant became quiet and appeared anxious and worried. Their poorer clothes, their inability to bank any money on bank day, their inability to attend the events for which admission was charged depressed them. It is entirely appropriate to call periods of financial stress *depressions*, for that is exactly the effect that they have on the emotions of both children and adults.

When the true circumstances give school children feelings of inferiority, they will turn to behavior by means of which they hope to restore their self-confidence. Generally, behavior intended to make up for the effect of real conditions is behavior that is undesirable and even antisocial. Before we go into detail on this point, let us discuss some emotional states, thus clarifying some of the points that have been discussed and acquiring a useful terminology.

### COMPLEXES

A complex may be defined as an idea, thought, memory, or concept that is surrounded by emotions and feelings. Generally we think of a complex as an idea with an unpleasant emotional tone, but a complex may also involve pleasant emotions. Many people are shot through with complexes. They possess many ideas and opinions that bring out definite feelings. Complexes show themselves especially when controversial matters are up for consideration; in a controversial issue, the conflict of ideas is generally not so strong as the conflict of feelings or emotions. In many situations, the emotions and feelings are dominant.

Boys and girls in the teens have complexes about each other. Most women, especially the unmarried ones, have a complex about their age. Certain feelings have developed about age because of what it implies in terms of romance, desirability, usefulness, and opportunity. We have complexes about political issues and about our former failures and successes. Our experiences give us many complexes, and we are fortunate if we do not become bogged down with many unhappy ones.

**The Inferiority Complex.**—A person has an inferiority complex if, when he becomes conscious of himself or when his thoughts are of himself, his feelings are those of inferiority. He believes that he is not so capable as others; he is not confident of himself;

and in many instances, he would like to avoid situations that bring him into competition with other people. In general, his feelings about himself are not happy, especially when thought of in relationship to others or in terms of difficult tasks.

A person with an inferiority complex is sensitive to criticism, and we say that he is "thin-skinned." He interprets as a slight certain behavior that was never intended to be disparaging. He is often on the defensive and keeps his authority in the forefront. If a joke is on him, he generally cannot respond to it in good part. A person with an inferiority complex likes to be flattered and responds to flattery with an ear for more. It elates him because it develops in him a feeling of superiority. Flattery makes him feel significant, whereas usually his feelings about himself are not pleasant.

Another indication of an inferiority complex is shyness and seclusiveness. A person with an inferiority complex avoids contacts with a group and does not like to be in a crowd. Instead, he tends to be seclusive and selects for his companions a few friends who cannot surpass him. Consistent with this point, the person who has feelings of inferiority avoids games and contests where rivalry is sharp. He is afraid of himself and is sensitive about situations that bring out comparisons with others.

Another term that might be brought out in connection with the inferiority complex is *introvert*. An introvert is one who introspects a good deal; he examines his own behavior and thinks about what he has done, is doing, and will be doing. He looks in on himself, so to speak, and is overly concerned about whether or not his actions are the best ones.

It is usually assumed that introverted people have inferiority complexes and also that people with inferiority complexes tend to be introverted. Ordinarily, methods that stimulate pupils to practice self-analysis may be regarded as not particularly good from the standpoint of mental health. For example, some schools employ methods that require the pupils to rate themselves on their attitudes and behavior. The teachers urge them to be conscious of their behavior and to evaluate it in terms of arbitrary standards. Children are thereby encouraged to introspect and might tend to become introverted and self-conscious. It is also doubtful that the method is a good one for developing desirable behavior, for children may become artificially good in specific

school situations but may react undesirably in out-of-school situations. In general, self-rating schemes should be used very discriminatingly, as it is desirable that feelings and consideration of self be not overly stimulated.

**The Superiority Complex.**—A person has a superiority complex when his feelings about himself are satisfying. Such a person is confident and goes forth unafraid to tackle a problem. He is not very sensitive and, unlike the person with an inferiority complex, is not easily "rubbed the wrong way."

A child with a superiority complex loves to dramatize himself; that is, he loves to participate and take a prominent part in activities. He generally likes to be with children and is at home in groups and their activities. Where the child with an inferiority complex tends to have his feelings and reactions converge inwardly, the child with a superiority complex is likely to extend his feelings outward to others. Consequently, we generally associate extroversion with a superiority complex. An extrovert, as opposed to the introvert, is one whose feelings and force of personality move out to others.

**Various Degrees of Intensity of Complexes.**—The intensity of complexes varies continuously from extreme to extreme. Some children are extremely introverted; and some, extremely extroverted. Most children are in between the extremes, feeling poor in some situations and better in others. The extremes are the seriously maladjusted ones. The child who has a decided inferiority complex is generally unhappy, and much of his behavior is conditioned by his inferiority complex. He behaves in a manner to make up for his inferiority complex, and generally such behavior is of a sort that does not stimulate other individuals favorably. Comparably, a child with feelings of great superiority is apt to behave in a manner that offends others. For example, if an individual is too extroverted, his attitudes and behavior extend to others so strongly that he may be offensive. He may appear conceited and aggressive. He will be resisted and rebuffed, with consequent unhappiness.

All in all, it is best for the mental health of a child if he can be placed in a situation where successes give him a feeling of personal worth. A sense of being more than equal to the tasks that one must do creates confidence and leads to a better emotional state.

No person is so capable that he is perfectly adjusted in all situations. In some, he gets along very well, and his accompanying emotional states or physiological reactions are satisfying. In others, he may not be successful, and the complexes developing from the experience in those situations tend to make him feel less adequate. In short, we experience a sense of adequacy in those areas of endeavor where we succeed and of inadequacy where we do least well. Thus, our emotions reflect the adequacy of our getting along in various situations and may include both inferiority and superiority. They should not be preponderantly one or the other, but the feelings of adequacy or superiority should be more frequent or dominate over those of not being able to respond satisfactorily.

**The Teacher and Complexes.**—The attitude of the teacher toward her pupils does much to form the opinion that they have of themselves. If she expresses faith in her pupils, recognizes their strong points, and adjusts the work to their capacities, she is apt to condition them to have desirable attitudes about themselves and their work. On the other hand, if she displays contempt for their abilities, minimizes their efforts, and is inflexible in her requirements, she will help develop associations that may give rise to unhappy emotional states. When these associations come to mind, the emotions surrounding them will be reinstated. The emotions may be either invigorating or depressing. The illustration that follows shows how emotional states accompany ideas and situations.

**Emotionally Toned Ideas.**—The following is a summary of an experience by the distinguished Austrian psychoanalyst Jung. A purse belonging to a member of his staff had been stolen by another member. The purse had not been returned, so Jung devised a plan for detecting the guilty person. He compiled a list of words containing a few that were closely associated with the theft—words naming the color of the purse, its contents, and the place from which it had been stolen. These were read to each member on the staff, who was directed to respond with the first word that came to mind. A record was made of the responses and of the time that it had taken to make each one. One member of the staff had difficulty in responding to the key, or critical words. She replied with unexpected words and took longer to answer. The record of her replies was so different from

those of the other staff members that Jung thought her guilty, and she later admitted that she had taken the purse.

The culprit had developed an unhappy emotional state because of her act. She had done something that made her uneasy because of the fear that she would be detected. When the words that set off associations with the stolen purse were read, the emotions that surrounded the stealing of the purse were reinstated. Because of the complexes set off by the key words, the girl could not respond to them so quickly as she could to the neutral ones, and her answers were unusual and different from those ordinarily expected.

**Complexes Interfere with Rational Thinking.**—Like this guilty girl, people full of complexes will be hindered in thinking clearly or in making normal direct responses to situations. They are often described as being emotional rather than rational. Their feelings, which are described as biases and prejudices, influence their reasoning. For example, the way we feel toward people influences our opinion of them and reaction toward them as much as and possibly more than the actual facts warrant. Thus, most of us overrate those whom we like and underrate those whom we dislike. Teachers are influenced when marking a pupil's work in part by emotional associations that they have had with that student. Similarly, children's lives are governed largely by their feelings. They are almost exclusively creatures of feeling; they seek the pleasant and avoid the unpleasant. Behavior is conditioned from birth by the emotional effects that the environment has upon people. Education should take into account the feelings and emotions of children as a fundamental factor in shaping their lives.

### REPRESSIONS

When we try to conceal those thoughts which are emotionally toned, we are said to be *repressing* them. In other terminology, it is said that we try to repress our complexes into the unconscious. We tend to repress our unhappy experiences rather than to express ourselves about them. We zealously guard against the exposure of those experiences and associations which tend to minimize us. We try to hide those associations which might lessen our prestige and to emphasize those which imply that we have good status.



Situations in which competition and rivalry are sharp make students overconscious of their weaknesses and deficiencies. Consequently, both children and adults repress all memories of incidents or circumstances that may lower them in the regard of their fellows. They tend to be sensitive and feel uncomfortable when any word or allusion brings out their weaknesses.

An illustration of the effect of repressed complexes is the case of a boy who was most desirous of being regarded as one of the most capable students in his class but whose intelligence test score indicated that his ranking in that respect was only average. Because of hard systematic effort, his marks were fairly high even though his I.Q. was not so high as those of many other children. His mental test ranking was a source of emotional disturbance to him, and he developed a complex about mental tests. During his school years, he avoided all reference to them; and as a college student, he avoided courses in which mental tests were given. Whenever the topic of intelligence tests came up in his presence, it set off in him all the emotions that he had developed because of his original experience with them.

The effect of repressed complexes is that the emotions are awakened whenever a stimulus or association recalls the emotions that surrounded the original ideas and experiences. Complexes, or emotionalized memories, do not just fade away. They are not destroyed by being repressed. One descriptive point of view is that buried complexes have a wearing effect on the nervous system. They are like little mice in our system gnawing away at the nerves just as rats and mice gnaw away at a rope.

A more scientific point of view calls attention to the interrelationship of the psychological and the physiological processes. Accordingly, the emotions are the response of the endocrines and the viscera, and various experiences set off those internal physiological reactions which may be either healthful or unhealthful depending on the emotion. When those memories, surrounded by unpleasant emotional tones, are recalled, we have an unhealthful experience. For example, our home background was of low economic status; our parents were not particularly successful; our home was on the wrong side of the track; and our brothers and sisters were ne'er-do-wells. Naturally, our feelings about our home situation are not very pleasant, so we repress all recollections and references to our childhood socioeconomic status.

Many occasions arise, however, when discussion and inquiry center on these matters, leading to the reinstatement of the physiological reactions that occurred when we originally became conscious of our early poverty.

If a person has many complexes, more occasions will arise when they will be touched off and awakened. Feelings such as worry, fear, and inferiority will be reinstated whenever an association touches off those complexes. Such a person is likely to be very sensitive and on the defensive. He will shrink from situations that might touch on his complexes and reinstate unhappy emotions. When his complexes are awakened, he may react with prejudice, and he is likely to show his emotions. He may become timid or even have a temper tantrum.

**Conquering One's Complexes.**—Instead of trying to smuggle away the complex, he should frankly and candidly recognize the situation that causes it. If a person has suffered a failure, he should mention it as a matter of fact to a few of his friends instead of trying to cover it up. He will ultimately suffer more harm from the distress of trying to conceal his failure and from the indirectness and falsehoods that such a procedure requires than from the impression made on others by their knowledge of his failure. In fact, in trying to fool others he fools only himself.

The way to get rid of complexes is to bring them out in the open by expressing them. If one has had emotionally toned experiences of which social attitudes tend to make one ashamed, such as having caused serious injury, having failed, or being of low social status, the best one can do is to face the situation frankly and recognize it. If the situation warrants it, one should mention the matter candidly without either concealment or exaggeration. Airing of a complex tends to destroy it. Telling a friend about it is the best way. Fortunate is the child or adult who can talk to friendly and sympathetic ears about his problems. Such a person can relieve himself of his complexes and literally eliminate them from his system.

The personality of the teacher is important in this respect. One who is friendly and sympathetic is in a position where she can help her pupils with their emotional problems. If pupils trust their teacher, feel that she is fair, and regard her as a friend, they will confide their troubles to her. They will thus destroy their complexes by discussing their difficulties.

Furthermore, under such a teacher the greater freedom and expressiveness in the classroom will also have therapeutic value. Investigations have shown that the best teachers are comparatively free and informal in the classroom. They appear relaxed and without the tension and stiffness that characterize teachers who do not have an easy command of their classes. Superior teachers are friendly with their pupils and generous with words of commendation. The greatest value in these teachers lies in their effect upon the feelings and attitudes of their pupils, for children in a freer atmosphere tend to act naturally and have fewer of those emotional states which effect mental health.

On the other hand, teachers who are mechanical and unsympathetic drive the pupils from them and do not win their confidence. The emotional life of the pupil becomes confined to himself, and the teacher by her methods has denied herself the opportunity of helping him. The teacher of this type, whose methods and personality regiments her pupils to a formal pattern of classroom behavior, not only fails to relieve the emotional stress of her pupils but actually increases it.

### CONFLICT

An individual has a conflict when he is upset by conflicting emotional tensions. He suffers emotional stress because he is torn by the problem of having to choose between possible decisions. He must decide on one act or course of behavior as against others.

Some people have been conditioned to regard certain aspects of behavior as so important that they suffer emotional stress and strain when they have to decide what to do. Generally, such individuals, whether children or adults, have feelings of uncertainty and insecurity. Consequently, they regard a decision as momentous, and conflicting emotions attend every situation that demands that one of alternative courses of action be decided upon.

The pupil cannot decide whether he will or will not study, tell or not tell the teacher, keep an article that is found or return it, take part in a mischievous lark or stay home. In each instance, if a pupil keeps fretting about making a decision, he will soon be in a miserable emotional state. A conflict can be so intense that it seriously affects the health. In addition, if a pupil

habitually develops the emotional states that accompany conflicts he will become ineffective, for he is dissipating his energies in coming to decisions rather than in executing them.

Generally, a person with many conflicts is one with an inferiority complex. Not having confidence in himself, he cannot make up his mind, and he unduly fears the consequences. Such a person is often dilatory. He procrastinates a good deal and never does anything until the last minute. When a decision is pending or tasks are waiting to be done, the conflicts upset the individual. Consequently, the undone tasks reappear periodically as annoyances and thus make personal adjustment difficult and contribute to more intense maladjustment.

The following example is typical of many. Jane was continually concerned about consequences and worried about what would happen if she pursued a given course of action and what would happen if she did not. She could never make up her mind. In school, she was harassed whenever there was an option; when choice of question was permitted, she could hardly decide which ones to attempt. Ordinarily, she wasted more time beginning to do her lessons than in doing them. As an adult, she postpones and delays. As a result, matters that should be done are left undone. Complexes result which cause irrational behavior and poor judgment. If she is buying a garment, she suffers emotional stress and strain; consequently, she often overlooks the better values and decides on the poorer ones. The emotions accompanying conflict render her ineffective in situations where choice or decisions must be made.

The best way to avoid conflict is to train children in a friendly environment. If there is an absence of tension in their early situations, they will make up their minds as a matter of course. On the other hand, if they are led to believe that what they decide to do is a life-and-death matter, they become conditioned to *Shall I, shan't I?* Yes and no; pro and con; if I do, and if I do not. Furthermore, adults should permit children to make many of their own decisions, to get the habit of making them and observing the consequences.

One should make decisions promptly. This does not mean making snap judgments unsupported by evidence but arriving at decisions as promptly and efficiently as possible. Some decisions are certain to be poor ones; nevertheless, those made

before emotional tensions begin to cause aberrations are likely to be the best ones.

People also have conflicts when their behavior is inconsistent with their ideals. Conflicts then tend to maintain good behavior. Generally, when people have to decide whether or not to do the unethical, their concepts of right and wrong come forward to check the tendency and to reinforce the tendency to do the ethical. Conflicts in this sense may be desirable, as they serve to balance and check behavior.

#### DAYDREAMING—FANTASY

When the realities of life make us feel that we are unsuccessful and inferior, we want to escape from them. The easiest way to do so is through daydreaming, or fantasy. In the dreamworld, we can satisfy our wants and wishes. When reality is too easy, we also tend to find escape in the world of fanciful imagination.

The poor child dreams of riches; the weak thinks of himself as a conqueror; and the overdominated child pictures himself in control. In the realm of fantasy, children more than strike a balance for their deficiencies. They overcome the incompatibilities of their environment by turning away from their difficulties to a world that they can order according to their fancies.

Many of our children's stories are pleasing for that reason. They satisfy our wishful thinking. Many of our favorite tales are based on the romantic fancy that the poor little girl meets the charming rich prince and he falls in love with her. The Cinderella story contains all the elements of a good retreat from reality—beauty, ascendancy over oppressors, and the final great triumph.

Children identify themselves with the characters in a story or movie. A girl sees herself as the heroine much admired by others and wooed by the hero. A boy, in turn, imagines himself playing the major role as the hero. Girls and boys identify themselves with their favorite movie stars and achieve the satisfaction of being in the spotlight. They forget the realities of life and see themselves in an elevated position. Through dreams, they get happiness and inflate their ego, or self, by imagining themselves as they would like to be.

Fantasy and heightened imagination would be very well were it not that the daydreamer has to get back to the actual situation.

When he does return to the true world, he is more out of line with it than ever before. Daydreaming has the effect of putting one's head into the imaginative world in order not to see the true situation. The best adjustment to make to circumstances that minimize the ego is to meet them and grapple with them, to work out a solution, not in the world of fantasy but in the world of reality. It is just here that the teacher and principal can function. They can note the children who are "absent though present" and give them interesting work that is fitting to their capacities. Projects and activities are particularly good in this respect, as they hold the attention of the child much more effectively than merely learning a lesson out of a book.

A little daydreaming is not undesirable, for it releases a child from the severities of his living. As such it is restful. Much daydreaming is serious because it is a symptom of maladjustment. A pupil who daydreams excessively is getting farther and farther away from reality. The problem is to capture his interest so that he will function efficiently in the real world.

#### RATIONALIZATION

The pupil may say that he does not care about the low marks he gets because they do not mean anything anyway. He may bolster his statement by referring to successful men who did poorly in school. A boy who did not do well in an examination stated that the other members in the class did better because they cheated. Another child does not do well in school because, he says, the teacher neglects him and pays much more attention to the other children. Let us assume that these are not true reasons, for they probably are not.

Such excuses or explanations are called *rationalizations*. They represent an attempt to rationalize, or find an excuse for failure or maladjustment. Rationalization thus consists of an apparent but untrue explanation. When we give what appear to be good and logical reasons for what we do rather than the true reasons, we are rationalizing. It is a process of concealing from others our true feelings and our actual motives, and we rather expect to deceive ourselves also. Through rationalization, we hope to overcome our complexes. In each of the cases used as illustrations, definite feelings surrounded the circumstances; by rationali-

zation, the individuals hoped to establish themselves well with others and also to satisfy themselves.

**Projection.**—One form of rationalization is to find the fault or blame in someone else. We call that form of rationalization *projection*, because the reasons are projected from the person himself to someone else. The pupil blaming the teacher for his failure is an example of projection. A husband may blame his wife for his failure; the businessman may blame the public; and the pupil may say that he could not hear the teacher or see the board. The facts may be that the husband failed because he drank and would have done no better no matter who had been his wife, that the businessman failed because he had conducted his business in the same way for the past 30 years; that the child was not doing so well as some of his classmates because he was not so capable and could not work so effectively. All these who rationalized tried to satisfy themselves about their inadequacy with excuses that put the blame on someone or something else.

One of the most common expressions of rationalization is that of the primary teacher who blames the home because the children are not doing well. The upper grade teacher blames the lower grade teachers because the children did not get the proper foundation. The high-school teacher blames the upper grade teachers; and the college professor finds fault with all the schools. Though at times the criticism may be justified, too often it is merely a means of shifting responsibility and avoiding the admission of one's own inadequacy.

**Sour Grapes.**—This form of rationalization has been illustrated by the commonly occurring excuse for not getting good marks because they do not mean anything anyway. The designation of this form of rationalization comes from the story of the fox who could not reach the grapes and then said that he did not care because they were sour anyway. Similarly, the man who fails to acquire money says that he is glad because when "wealth accumulates, men decay," and that wealth dulls the interest and serves as a handicap. We reason to ourselves that we are best off because that which we do not have is "sour." We obtain satisfaction by minimizing the value of that which we do not have and have been unable to get.

**Pollyanna-sweet Lemon.**—A person may adjust to a situation where his true adjustment has been unsuccessful or where the

actual circumstances have thwarted him by assuming a Pollyanna attitude. Such rationalization consists in saying that it might have been worse or that it probably is all for the best. Even though the situation is a bitter or sour one (lemon), still a "sweet" attitude is assumed. A statement by the poor that they are best off because they have least to worry about and that working against handicaps develops character represents a Pollyanna attitude. Decrying the evils of money illustrates a "sour-grapes" attitude. These are opposite ways of reacting to the same situation; both are undesirable. Similarly, a child that pretends he is always satisfied and that he is always treated well is rationalizing. His adjustment is, like that of the chronic complainer, an unsatisfactory one; he needs to view the situation more realistically.

Rationalization, whatever form it takes, is an unrealistic method of adjusting to a situation. The person who rationalizes is untrue to himself. It is doubtful that he is completely unaware of what he is doing, for the emotional tone associated with rationalization is not a satisfying one. Rationalization therefore does not remove complexes but accentuates them. Because complexes are unsuccessfully hidden by rationalization, the danger in the complexes and their rationalization is that they will express themselves indirectly in misbehavior.

### COMPENSATION

This is one of the most common mechanisms in human behavior. If a person is deficient in one respect, he behaves in a manner that overcomes or compensates for that weakness. Compensation, then, consists of behavior intended to overcome or make up for an inadequacy. For example, the boy who is poor in school has a standing with his fellows on that basis that is displeasing to him. It is a universal trait in man to seek the admiration of his fellows and to dislike occupying an inferior position in their opinion. Therefore, the boy who is thought less of because of his school disability will in some other activity set out to earn the approbation of his fellows. A method that is usually successful consists in misbehaving. His fellows will admire him for his exploits and refer to him as a boy who has "nerve" and as one who is not afraid of the teacher. Another way he has of attracting admirers is to spend money on his friends.



He may take to stealing money in order to treat them. With this money he may also provide himself with gadgets and equipment for which the other boys will envy him. His inferior status has been supplanted by the new status that he has achieved and in which he is prominent. The failure of this compensation lies, however, in that it is antisocial and represents more maladjustment.

An adequate normal life consists, on the contrary, of finding successes that are socially beneficial and that will lead one and one's associates to overlook one's deficiencies, to cover them over and forget them with varying degrees of success in his other endeavors. If a man is a good salesman and achieves a feeling of personal worth from his successes, it does not matter to him that he was not very good in school or that he is not a good musician. Each of us should develop his best abilities in order to acquire a maximum of success. If we are good in our occupation, thereby receiving approbation from our fellows, we are not so likely to be worried by deficiencies that certain other situations have brought out.

Compensation is therefore, as has been said, a type of behavior engaged in to overcome a feeling of inferiority. This was the case of a young man who had an unpleasant feeling of inferiority because he was physically small and weak. He preferred thinking of himself as large and strong. In order that he might have a better opinion of himself and also that the attitude of others might be one of respect and admiration, he developed into a "little fighting cock." In a meeting, he would rise up and heckle the speaker or challenge anyone on an issue on which he disagreed. When anyone offended him in city traffic, he crowded the offending car and driver over to the curb and attacked him vociferously. In case of sharp dispute, he would even take a fighting stance. This behavior was satisfying enough until he carried it to a point where he was knocked down. He liked to be in the drama of affairs and play a leading role, to feel that he was important.

Another example of compensation for inferiority is the person who assumes a proud, arrogant, and haughty air because he is socially inadequate. The boy or girl, man or woman who does not possess the ability to get along well with others may appear distant or snobbish. It might be thought that this individual

feels himself too worthy to associate quite generally with the people, but that is not often the case. The assumed dignity usually represents a defense mechanism. With a superior air, he sets himself apart from his fellows because he feels uncertain about his ability to get along with them. Actually, he feels socially inferior and is compensating.

Some compensation is natural enough and desirable. Compensation is undesirable only when it leads to worse emotional states and to antisocial behavior. When the boy who is poor in sports turns to his formal schoolwork more wholeheartedly in order to obtain his satisfactions there, he has found a desirable form of compensation. Similarly, if a pupil is particularly apt in music and devotes special effort to this art in order to compensate for weakness or mediocrity in other departments, we also see an acceptable form of compensation. Or, again, a man who may be inferior socially and works doubly hard to gain eminence in business or in science is compensating in the right way.

It is said that some reformers are people who are attempting to compensate for a failure or a feeling of inferiority. They derive satisfaction from crusading by trying to persuade others to change their manner of living. The reformer thereby takes a position of authority and superiority. Perhaps some world leaders are compensating for an inferiority complex. By overdeveloping in the opposite direction, they become dominating and dictatorial. In a limited sense, dictators, too, are reformers. Probably Hitler and Mussolini have feelings of inferiority in some situations that they compensate for by being autocratic dictators. It is doubtful that compensation completely accounts for an overdeveloped desire for power, but it is probably a factor.

In like manner, the emotions and attitudes of a teacher may also condition to a considerable extent her methods of teaching. Some teachers are very authoritative in their manner and do not welcome inquiry by their pupils; they regard their own word as final. The procedure is mechanical; the textbook is followed closely; and the teacher maintains strict control. Curiosity on the part of the pupils that expresses itself as inquiry for additional information is regarded by her as an attempt by them to check on her knowledge of the subject. It places her on the defensive.

This type of teacher—and there are many like her—is not sure of herself. She probably knows of her weaknesses and defends

herself by being arbitrary and authoritative. She develops a feeling of superiority by placing herself over her pupils, subordinating them to her. The truth is that much of the reward that teachers get from teaching is the satisfaction that they derive from being in authority over their pupils. In that position, they can dramatize themselves and acquire a feeling of worth. All this is very good for the teacher but probably not for the pupils.

The teacher who is freer of complexes, who feels surer of herself, can permit more liberty. She does not have to set up defense mechanisms but can act as a helper to the pupils rather than as crew foreman. Teacher and pupil can work on projects cooperatively; and if unforeseen difficulties arise, the former, not being on the defensive, has a temperament that enables her to make a good adjustment. If she is a good teacher, she encourages inquiry, promotes experimentation, is hopeful of new situations, and attacks new problems with her pupils; she is a learner with them rather than one who knows all the answers.

#### WORRY

Many children worry about their school marks, the progress that they make in school, or the impression that they make on their classmates and on their teacher; some worry about their health and about God and the hereafter. Most worry centers on security or on self, as most complexes do. These two fundamental aspects of life are the ones that also cause adults to worry. It has been estimated that if people did not have to be unduly concerned about their security—the means for buying food, shelter, and clothes—the worries or emotional tensions would be removed to such an extent that over half the nervous breakdowns and psychopathic cases would be prevented.

The school situation, too, develops anxieties. It sets such value on school marks, goals, passing, prizes, honors, and rivalry that many pupils feel insecure in a competition that results in continual ratings and classifications, with extra promotions for some, survival of others, and retardation and elimination for still others. Children worry in such a situation. They worry over the past; they are deeply concerned about the present; and they dread the future. Many children, of course, do not worry; it would be desirable if some were more concerned about the

problems before them. Still, it is probably better that they be emotionally indifferent to the work at hand than that they be overly concerned about their lessons.

In part, worry consists of surrounding the thought of that which has occurred with feelings of overconcern. It also consists of feeling too keenly the consequences of present behavior and having a fear and dread of what will happen in the future. It is futile to be distressed about the past or to anticipate pessimistically the future. Reasonable concern about the present is a desirable degree of worry, if one wishes to call it that, but to be under excessive emotional tension causes one to function less effectively.

#### DIFFERENCES IN THE RESISTANCE OF INDIVIDUALS TO EMOTIONAL STRAINS

Children as well as adults differ in the extent to which they can withstand the forces and conditions that cause disturbing emotions and distorted behavior. Some individuals can experience almost continuous failure, be in the most unhappy situations, and still maintain a healthy outlook toward people and conditions. Such persons are sturdy, figuratively being like the football player who survives bruising play without injury. At the other extreme are individuals who become maladjusted very easily. Their resistance to troubling circumstances is slight. A single defeat, an unfavorable comparison, or the conflict of motives causes aberrations in behavior. There are even those who are so tender and inadequate that they become maladjusted in a simple environment.

Most children and adults fall between these extremes, being average in their resistance to the forces that cause complexes, conflicts, compensation, worry, repression, misbehavior, and other emotional states and problem tendencies. This means that most pupils can be adequately adjusted if the environment is controlled for them so they are not stimulated to react unsocially. It also means that everyone has complexes, compensates for feelings of inferiority, departs from the world through fantasy, is torn by conflicts at some time or other, and sets up defense mechanisms. The normal, or average person does not have enough of those emotional states to influence his behavior sufficiently to cause serious maladjustment. Some experiences

may touch off the emotional states of certain complexes, but they are not dominant enough to distort the behavior. The individual is able to stay close enough to reality or the actual situation to adjust adequately. Happy emotional balance and effective behavior are a matter of degree. A few are exceptionally well adjusted to their environment; most people are more or less adequately adjusted to it; and some are depressed by their inabilities and respond ineffectively.

### MALADJUSTMENT AND ILLNESS

Continued maladjustment often leads to illness. That consequence is natural for two reasons. In the first place, the organic responses of emotions, such as the reaction of the glands and organs of the body, may lead to their malfunction; and, furthermore, illness takes one away from his difficulties.

Illness places one in a position where he receives special attention. Parents, friends, doctors, and nurses show him special consideration when he is sick, and he thus acquires the feeling of importance that develops when one is the object of tender solicitude. Illness serves to attract attention and gives one an excuse for failure. Study carefully the child who develops bad headaches, who tends to have vomiting spells, or who volunteers the information that she is delicate and high-strung. A child endeavoring to escape from an unpleasant situation may do so by seeking sympathetic attention. In these cases, illness is a symptom of maladjustment and calls for an attempt by the teacher to create a more favorable environment for these pupils.

### TEMPER TANTRUMS

The temper tantrum is often an outgrowth of a dispute between the child and its mother. If the child insists on having a cookie and, after an argument, the mother refuses, he will lie down on the floor and scream and kick. The mother will often worry because the child has become quite flushed and is gasping for breath. Ordinarily, she then yields to the child's wishes and pets and placates him. The child has achieved his point and, in addition, receives sympathetic attention. If, however, he is permitted to dissipate his energies in the temper tantrum or to carry on without anyone's paying attention to him, he will grow tired of having tantrums in vain and will realize that they serve no purpose.

It is natural for people to have tantrums in one form or another. As infants and children, they had their wants satisfied when they cried. Furthermore, when as children they were irritable and peevish, their mothers gave them special care. Displaying a sharp emotion when quarreling with other children generally won the point in dispute. From infancy to adulthood, the display of feeling and emotion achieved various objectives.

In a similar manner, older children and adults manifest feeling to get what they want. The boy in his teens displays a fit of temper, and his companion yields; if, however, his companion becomes equally angry, they have a fight, which is a common method by which adolescents settle their differences. At a conference, the chairman rises out of his chair and appears ruffled; the other men agree with him to avoid a conflict. In a meeting, a member shows anger and walks out, expecting to be asked back with the inducement that his point will prevail. The teacher, too, sometimes shows her temper, and the children often comply only because they think that she will react violently if they do not comply. Anger and irritation are rudimentary forms of behavior and in many situations are not the most useful. Cool, rational conduct is most effective because it is free from the emotionalism that blocks clear thinking. That we recognize the general truth of this statement is revealed in the common belief that the man who loses his temper does not know what he is doing and that the man who keeps his has self-control.

#### ESCAPE AND DEFENSE MECHANISMS

Illness as it has been described here may be an escape mechanism; it is invoked to get away from an uncomfortable situation. Fantasy, or daydreaming, too, as stated above, is used to get away from reality. Also, when a person identifies himself with the big gangster, the world-famed beauty, or the hero of the hour, he is getting away from himself and his own situation.

Defense mechanisms are means of protecting the ego. Thus, we set forth the plausible, not the real, reasons for our actions. Compensation is a method of getting away from certain feelings by developing the opposite ones. It is also a defense mechanism in the sense that we are trying to defend ourselves against certain impressions. Thus, the person who senses that he is weak is on the defensive when he makes his authority obvious.

Negativism, also, is a defense mechanism. By *negativism* we mean a tendency to refuse to act in accordance with a suggestion or a request. The common response of the negativistic child is "No," "I won't," "I don't want to," or their equivalent. He says that he does not want to play with other children; when a suggestion is made, he is generally against it. He is stubborn in the sense that he does not cooperate well with others.

Negativistic people take the opposite side; they tend to be contrary. Even if shown a correct method, the negativistic child or adult will not accept it, though he knows that he is wrong. For example, a girl while practicing the piano struck the wrong key and was informed by her mother of that fact. Being negativistic to her mother's suggestion, the child persisted in striking the wrong key as long as she practiced that lesson. When she resumed practice at another time, however, she struck the right key and played correctly.

The defense mechanism described as negativism is employed to maintain one's self-respect. Thus it is like some forms of compensation. By putting up a "no" around oneself or being contrary, one maintains his independence and incidentally avoids conflict.

All mechanisms for enhancing one's status in the estimation of oneself and others may be called "plus gestures." Taking the opposite point of view, saying "no," showing authority, being boisterous to attract attention, and exhibiting exaggerated mannerisms are "plus gestures." They are symptomatic of maladjustment. They indicate that the individual is trying to make up for feelings of inadequacy.

#### SUMMARY

One of the mainsprings of maladjustment is the desire of almost everyone to have good status and be well thought of by his associates. Everyone wants a feeling of personal worth. People have complexes about many things, but probably the most influential are those about self. When consciousness of self is associated with feelings of inferiority, the complex is an "inferiority complex"; and when the feeling is one of superiority, the complex is described as a "superiority complex." In this connection, the introvert is often mentioned as one whose psychological forces move inward, whereas in the case of the

extrovert the forces extend outward from the individual. When ideas are emotionally toned or when feeling permeates one's thinking, it is influenced, and the thinking will be less effective.

When experiences that are surrounded by unpleasant feelings are pushed into the subconscious, so to speak, in order to get rid of them, it is said that they are being repressed. Whenever they are recalled, however, the memory of these repressed experiences revives the original unpleasant emotions and feelings. Attempts to guard the repressed ideas and the unhappiness set off when the emotional tones are revived sometimes result in bad mental health. The way to get rid of one's unhappy complexes is to discuss them with a friend or to develop the habit of dealing with them in a spirit of levity. The sympathetic ear of the teacher can be the burial ground for many unhappy experiences.

When an individual is torn by two conflicting ideas, he is said to have a conflict. He should develop the habit of making a decision and then not giving any reason for it. It has been said that the decisions are likely to be right but the reasons given for the decisions wrong.

When life is difficult and unstimulating, a child is inclined to create a happy imaginative world by daydreaming. This escape from reality if engaged in excessively results in maladjustment, because the child or adult finds it increasingly hard to adjust in the real world.

Rationalization consists of devising logical but untrue explanations of one's behavior. It is generally done to "save one's face" or to satisfy oneself and look well in the eyes of others.

Compensation consists of behavior intended to make up for a weakness or deficiency. Thus, if a person is not well thought of because he is small, a poor student, or of poor economic status, he is likely to do certain sensational things such as defying the teacher's authority or stealing so that he will gain the admiration and respect of his fellows.

It is desirable that a person's worry take the form of reasonable concern for his welfare, but worry is unhealthful when it results in emotional tensions about what has been done, is being done, and will be done.

People differ in their resistance to the forces of life and the conditions that cause aberrational behavior. Most people fall between the extremes of great resistance and very little, and some



individuals show maladjustment in some situations but not in others.

A person may become ill in order to rid himself of his problems and also to gain the attention for which he longs. Children and adults also go into temper tantrums to get attention and to achieve the purposes that they have not been able to achieve by rational means.

Several of the mechanisms described in this chapter may be classified as escape and defense mechanisms. When a person assumes illness or represses his complexes, he is trying to escape from reality; and when he is negativistic and when he rationalizes, he is setting up defenses. These various mechanisms are symptoms of maladjustment and also accentuate maladjustment. The best solution lies in facing reality or being in an environment that is not too complex or too simple.

### Problems and Questions

1. Give some illustrations showing that people are concerned about having a feeling of personal worth. Discuss whether or not you think it is desirable that a person have this attitude about himself.

2. Give and illustrate a number of complexes that people have, and indicate how complexes have physiological and psychological effects.

3. Describe the thinking processes of a person who is shot through with complexes.

4. A man who moves to a new place has had many experiences about which he does not care to tell. Therefore, he has many emotionally toned ideas bottled up. How is that likely to affect his behavior? Explain how one can avoid repressing one's complexes.

5. A certain pupil when left on his own initiative is very unhappy and wishes that his teacher and parents would make the decisions for him. Describe his condition.

6. In one school, the behavior of each pupil is definitely controlled from the time he leaves home until he arrives home again after the school day. In another school, the child is given considerable freedom and must make many choices and decisions during the day. Discuss these two schools in terms of emotional conflict and adjustment in general.

7. What is the objection to children's reading a large number of fairy tales and attending the movies frequently?

8. What do you prescribe for a child who is in the dreamworld much of the time?

9. Give illustrations of rationalization.

10. A certain man assumed a very dignified air; he was hard to approach and was arbitrary and authoritative. Furthermore, he tried to keep his environment as simple as possible. Try to give the reasons for this behavior.

11. Describe worry that is desirable and the worry that is both ineffective and injurious.

12. Describe some situations in which a child gets sick because of his mental state.

13. How should children and adults with temper tantrums be treated?

14. Discuss the various forms of maladjustment as either defense or escape mechanisms.

### General References

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## CHAPTER VI

### MENTAL HEALTH, BEHAVIOR PROBLEMS, AND DISCIPLINE

**Directions for Study.**—Learn how success and failure influence mental health.

Why are friendliness and helpfulness so essential in the schoolroom?

What is meant by *overprotection*?

What are the advantages of a definite routine for certain more or less mechanical elements in our behavior?

Observe whether or not the author believes that it is a comparatively simple matter to correct the maladjustment of pupils and to restore mental health.

Considerable discussion is devoted to the seriousness of various types of behavior. Explain carefully the types of problem, and be able to enumerate and describe the more serious and the less serious.

Boys and girls with certain traits and characteristics are more apt to become maladjusted than others; note carefully just what those factors are.

#### MENTAL HEALTH

The various manifestations of mental aberration that have been described and illustrated are those which are more or less common to everyone. Only those individuals who have them in an extreme degree require special medical and institutional care. The psychoses constitute a special problem and are of less concern to the teacher than are complexes, worries, conflicts, repressions, compensation, daydreaming, and other symptoms of maladjustment that she is likely to encounter in the classroom.

**Success and Failure.**—Probably no other factor is so important in determining mental health as are success and failure. Whereas failure dulls the interest and affects people so that they employ escape and defense mechanism, success gives one confidence and

"increases the steam" for attacking new problems; nevertheless, success must not be too easy, as easy victories dull the interests also. The effect of success on feeling and effort is illustrated in the method of selecting and preparing bronchos for a certain rodeo. The day before the rodeo, the cowboys mounted the unbroken horses. The riders made the horses buck and kick with all their might, and the horses were always allowed to unseat the riders. Having felt success, the bronchos were conditioned so that they were especially hard to ride the day of the rodeo.

The school situation can be adjusted in such a way that every pupil will be successful according to his own capacity. The subject matter, for example, can be graded so that its difficulty is known in terms of the minimum mental age required to do the work. When the difficulty of subject matter is measured in terms of the capacity to learn, a pupil can be given the curricular diet that he is able to assimilate.

This procedure will require a keen recognition by the teacher and principal of individual differences in the intelligence and emotional stability of children and may necessitate less interest in subject matter and more in human relationships. Generally, the teacher makes some attempt to put the pupil above subject matter, but her classes are often so large and her pupils so heterogeneous in ability that she has work enough in establishing the rudimentary educational processes and therefore can pay little, if any, separate attention to the individual members of her class. If she pays special attention to the dull and teaches to the lowest common denominator, she will neglect the average and the bright. Similarly, if she tries to deal effectively with the bright, the majority of the class will be neglected. It is difficult for the teacher to strike a balance between the degrees of brightness that she finds in the 30 to 50 or more children in her room. Still, a keen awareness of the individual child will help, especially if children are well classified, and if the classes are not too large.

Success should be measured as far as possible in terms of the ability and efforts of each child. The dull child will always be a failure if he is compared only on a subject-matter basis with the bright child. The accomplishment quotient that is described on page 457 was thought to be a device that would evaluate each pupil according to his capacity. Unfortunately, it has inherent deficiencies and does not work out as intended. The

principle is just, however, and pupils should be recognized and rewarded according to their own abilities and not according to scales whereby the dull are compared with the bright and the only standard is the subject-matter standard.

In terms of the mental health of the child, grading and marking should not be given much emphasis. To say that fully 90 per cent of the rating and marking of written lessons, of recitations, and of a month's, six weeks', or a term's work should be eliminated may seem a radical statement, but such a large reduction in the formal evaluation of a pupil's ability would have a very healthful effect on the emotional life of students. They should come to a school to be helped and guided. The school should be an agency for helping in the emotional and intellectual development of children; but as it functions now, it is so much a rating and marking agency that some of its effects on children are highly injurious. A child's emotional and intellectual life is not improved by the tensions incident to anticipating and receiving marks and ratings.

If a child must be marked or rated, provision should be made so that all may experience success. The standards should be within the reach of all. Thus, there should be different goals of quality and achievement suitable for all children, some high enough for the brightest pupils and some low enough for the dull. When children of all abilities are together, it is difficult to adjust the situation so that all may meet with some success, but the teacher should possess the desire to accomplish this and work for that objective.

**A Friendly Atmosphere.**—The teacher can do much in a direct personal way to give pupils satisfaction. If she is kindly, sympathetic, and patient, she will make the children satisfied with themselves when, through their sincerity and effort, they deserve it. Such a teacher will commend and encourage her pupils. There will be times, of course, when they will experience dissatisfaction, but most of the time they will feel satisfied.

In such an atmosphere, the pupils will not feel the oppression that causes them to be sensitive, shy, and secretive. Neither will they suppress their feelings, for they will be at ease in a friendly environment.

This, of course, does not mean that they are to express all those transitory feelings of temper and irritation which are here

one moment and gone the next. These passing reactions do not form a complex, as do those produced by a prolonged situation. Some inhibition and some control is essential in order to react effectively to both the friendly and the unfriendly forces that play upon the human organism.

A teacher needs the good will of her pupils because without it she will find it hard to influence their behavior. When a public speaker amuses his audience by telling a pleasant story, he recognizes the importance of gaining their good will if he is to affect them favorably. If a speaker antagonizes his audience, he cannot persuade them; or if a teacher antagonizes her pupils, she will have little opportunity for helping them with the development of their character and temperament.

A desirable relation exists between teacher and pupils when the latter will speak to her about their worries, fears, and other emotional problems. A sympathetic ear will hear more children's troubles than most people imagine children have. The teacher can do more than provide a sympathetic audience. She can help the child by letting him take charge of some of the classroom activities; she can help him with his lesson difficulties, praise him judiciously, confer with parents, and use other methods that will help solve his personal problems.

The effect of the teacher's understanding and assistance is illustrated in the case of a girl in her junior year in high school who felt so inferior and timid that she was often distressed because of the group's reaction to her. She was a most capable student, but her recitations never evoked any favorable reactions from her fellows. Once she made a report to the class that she had prepared very carefully with the hope that it would stimulate her classmates to a discussion of what she had said. Her paper was excellent from an academic point of view but so abstract that the pupils found nothing in it to discuss. Silence followed her paper, and she was miserable. If she could have discontinued school, she would have done so. The teacher sensed her difficulty and made a point of praising her for her work. She took the initiative in reacting to her contributions, setting forth the ideas more interestingly and cleverly bringing the members of the class into a discussion. The teacher also asked her to help with the preparation of certain lessons and singled her out for attention in other ways. It was not easy to establish in this

sensitive, introverted girl a feeling of personal worth, but the teacher's continual vigilance kept her in a fairly wholesome emotional state. She showed much less tendency to withdraw from the group and felt much of the time that she was regarded favorably by her fellow students. In many similar cases, the first step toward correcting the maladjustment is to give the student confidence and a sense of being of value to the group.

**Overprotection.**—Some children are raised in cotton and wool batting, figuratively speaking. They have been too much protected by overzealous parents. When the young child plays with other children, the parents watch the play closely to protect him from the others' aggressiveness. They rush to attend every physical and emotional bump that their children receive and keep them from this activity and from that situation because they think the exertion too severe. Overprotected children obviously do not become independent and self-reliant.

When such children are away from their parents and are responsible for themselves, they cannot adjust well because they have never been trained to do so or left to their own resources. When a teacher tries to govern them, they turn to their parents, who often interfere with the teacher's efforts. The children of too solicitous parents never learn to walk alone, figuratively speaking, because they are not given a chance; they reach adulthood leaning on their parents and emotionally never become mature.

**Definite and Orderly Habits.**—Regular habits are conducive to good mental health because they eliminate much uncertainty and irregularity. A definite routine and procedure avoids indecision and conflict, because an individual then proceeds in a prescribed way. Order is established, and the emotions are not aroused by many of the situations that confront the person who proceeds in a hit-or-miss fashion. Habits save time as well as physical and emotional energy. If the child learns to go to school, begin work, come to the table, and do the many routine tasks of the day promptly and with despatch, a long step is taken toward the preservation of mental health. Although a person should not become a slave to habit, there are many recurring events of each day to which he should be habituated.

Orderliness results from clarity and concreteness of directions. In a situation where directions are clear and direct, objectives are understood, and certain elementary routines are established,

many complexes and conflicts are avoided. A child will then know specifically what he is doing and acquire a feeling of security conducive to good mental health.

Thus the teacher should be clear and definite in dealing with her pupils. This does not mean that she should govern with autocratic finality but that she should be specific and straightforward in her work with them. The assignment or the problem at hand should not be set forth in such a fragmentary, disorganized way that doubt and misunderstanding result. The children should not always be "left in the air," so to speak.

**Work and Rest.**—A pupil is in the best emotional state when work and rest are judiciously alternated. Highly keyed attention over long periods results in emotional fatigue. In fact, an otherwise excellent teacher may have an unwholesome effect on her pupils if she keeps them highly emotionalized with keen interest in their work. Hardly any pupil can rivet his attention on his lessons throughout the day and be free of the effects of excessive emotional drain. Happy work is the best physician, but work must be alternated with periods of rest. It has been said that a child should have a dull, uninteresting teacher for a part of each day; then his attention will wander, and he will become emotionally tranquil; he will be protected from overstimulation. Thus dull teaching has a hygienic value. Practically it is better to alternate interesting teaching, which keys the attention of the pupils to a high pitch, with rest periods or with relaxing work rather than with dull teaching.

#### **DANGER OF OVERSIMPLIFYING PROBLEMS OF MENTAL HEALTH**

There is a tendency for writers on mental health to oversimplify the causes of emotional tensions and their treatment. It is comparatively easy to discuss the influence of emotions and feelings on behavior and to describe various defense and escape mechanisms. Many examples occur to an experienced observer that illustrate complexes, conflicts, compensation, and similar aspects of behavior. Also, it is easy to set forth the reasons why emotionalized attitudes have developed in various individuals and to prescribe the remedies. It is not difficult after one acquires the terminology to say that a child has an inferiority complex because he is smaller than other children and that he compensates by being a behavior problem in school



in order to gain the admiration of his classmates. On the other hand, he might have become timid and shy and withdraws from other children in order to avoid the comparisons between himself and them. To illustrate further, it is easy to prescribe that a teacher should discover in this youngster a special ability that he should develop so that he will feel satisfaction in the particular strength that he does have.

All this is very good, but it is not so easy to bring about a successful adjustment as to speak of it. Nevertheless, teachers and parents who understand the various complexes, their courses and manifestations, have a great advantage over those who do not, in helping children who have these personal problems. The teacher who thinks that by severity he can condition all children into making a good adjustment is at a great disadvantage compared with the teacher who understands the relationship of ability and external characteristics to their feelings and emotions and the relationship of the latter, in turn, to overt behavior. Still, even the best informed teacher will find it extremely difficult, for example, to change a worrying, high-strung child to one who calmly and deliberately goes about his work. He will also find it hard to transform a shy child into one who is wholesomely extroverted and whose participation in group activities will have the effect of restoring his self-confidence. Moreover, what can a teacher do to adjust those dull children, overgrown for their age, many of whom have already become behavior problems?

The teacher need not feel that the situation is hopeless. It is far from that, and he should not be pessimistic. Still, the teacher, or anyone dealing with human beings, must recognize the fact that it is not easy to change the emotional life and behavior of those who deviate considerably from the normal. Circumstances such as the school, home, and companions, which were responsible in part for the deviation of an individual, usually continue to influence him. One circumstance may be changed, but it is practically impossible to change all of them. Furthermore, the individual himself continues to have the same nervous system, glands, and senses. Therefore the problem of modifying an individual's behavior is a very complicated one. Those who deviate much from the normal may have inherited a particular constitutional weakness which is the basis for a

tendency toward emotional instability. Furthermore, their environment out of school may be unfriendly, thus bringing out their weaknesses and developing emotional instability. The teacher may, under these circumstances, do his best to control the stimuli that play upon the child and still not be able to overcome the effect of the home and other situations causing the maladjustments. Nevertheless, if he has an attractive personality and is skillful enough to control the school situation so that the child is adjusted in school, he will do much for his emotional life.

A realistic attitude is the most effective. Analysis of problem children should take into account the actual factors that influence the child's behavior. There is hardly a phase of educational work where there is more fanciful and wishful thinking than in dealing with problem cases. Some explanations of the emotional unbalance are often far-fetched, and the prescribed treatment shows a faith that is not far remote from that in magic. The problem is extremely complex; it is often difficult to diagnose and even more difficult to remedy. The teacher should maintain an experimental attitude so that if one mode of dealing with a maladjusted child does not function, he can try another.

#### BEHAVIOR PROBLEMS AND DISCIPLINE

Certain behavior is considered acceptable because it is thought to contribute to the progress and happiness of the individual and the group, whereas other behavior that is disturbing and causes a waste of time is considered undesirable. The teacher is most sensitive to student behavior that causes disturbance, such as noisiness, whispering, talking out loud, and general disorder; for if she can maintain a quiet, orderly room, she is generally regarded as a good disciplinarian. Most principals and teachers feel that the behavior of the children is being properly developed if the pupils cause no disturbance.

Neither teacher nor principal, however, should regard the problem of child behavior as being solved by merely maintaining order. Earlier discussion indicated that emotions and feelings are the bases of maladjustment which calls for more than external order and discipline. In fact, the kind of quiet that results from a teacher's vigilance is often conducive to poor mental health. By acting as both foreman and policeman, the teacher maintains

order but suppresses her pupils in so doing. The result is not a natural and wholesome development. A child does not learn to be truthful and self-reliant in such a situation. Character does not develop in an environment in which the child is completely ruled by the teacher. A wise observer said: "A liar is born of fear on the one hand and tyranny on the other; truth comes from the lips of courage. It is born of confidence and honor."

A child grows best in an environment where he is free to express himself in socially useful ways. Freedom of this sort does not imply that control and guidance be abandoned but rather that they should be used with a view to stimulating the child to increase the variety of his independent responses. Teacher control of the typical sort that maintains order and establishes procedures by the rigorous compulsion method does not develop the independence, initiative, and self-control of the pupils. Their overt behavior in the classroom may not be disturbing, but they may not have learned how to conduct themselves without supervision.

An illustration of this point is the following. A young man became the principal of a small school where the pupils' misbehavior had interfered seriously with the school's effectiveness. The discipline had been so poor that the school situation was described as chaotic. If complete expression and lack of inhibition contribute to mental health, then these children had no repressions or complexes. It is probable that they had better mental health during the year of extreme disorder than they did after the new principal took charge with a firm hand and established strict discipline.

The school was transformed from a chaotic state to a very orderly one. The children marched into the school building and out of it keeping step. No talking or whispering was allowed. They were not permitted to enter or leave the schoolhouse informally, quietly talking to each other as people usually do when they enter or leave a public building. Even the activities on the playgrounds were closely supervised. The principal or another staff member was always on the grounds with the children to make decisions and to prevent any possible confusion.

To the townspeople it appeared that the school was very well operated. As they expressed it, "Everything is running smoothly." There was no disobedience, and the teachers were

in control. State inspectors, too, regarded the school as maintaining good standards of behavior and achievement.

The test, however, of the effectiveness of a method of control and discipline is the behavior of children when the pressure of the teacher is removed. Will the children carry on by themselves? Have they learned to be self-reliant and to exercise self-control? In the present illustration, the method was found to be a failure when the children were left to themselves. One recess, the members of the staff were called to a meeting, and thus the children were left on the playground without supervision. The children did not engage in organized games, as they always had done under the direction and guidance of a teacher. Instead, they ran about the grounds helter-skelter, throwing missiles at each other, the bigger boys making piles by throwing the smaller boys on top of each other. There was complete disorganization—complete breakdown. A discipline that had seemed good went to pieces when the control was removed. The children had not learned to govern themselves, because the restraining force was imposed upon them from without. The strict methods employed by the teachers and principal made the children like horses that could be driven but ran away the moment the driver dropped the lines and left the wagon.

This illustration brings to mind an attempt to solve the problem of the share croppers by putting them on a 40-acre farm to operate independently. The plan did not work because these share croppers had always been under strict supervision. Someone else had always made the decisions for them, decided what to plant, when to do it, when to harvest, and when to plow. These same farmers on a farm of their own did not succeed because they could not do anything independently. They had never been trained to carry on alone or to control themselves.

In a country with a strong dictator, the people seem well behaved and satisfied. Generally, however, the time comes when the force of the dictator is not adequate for suppression, and the people break out in serious disorder. The power of good behavior develops best in a democracy. This principle applies to a school as it does to a nation. If the teacher wants to develop in her children the power to behave well when they are out of her sight, she must teach them to share with her the responsibility of control.

## THE SERIOUSNESS OF PROBLEM TENDENCIES

In order to deal effectively with behavior problems, a knowledge of the seriousness of different problem tendencies is important. Conceivably, a boy may be troublesome in school because of his enthusiasm and a tendency to be overt in expressing his feelings. He may, for instance, whisper, talk out loud, and be noisy and still be very well adjusted emotionally. On the other hand, a child who hardly ever attracts the attention of the teacher may be developing potentialities for serious misbehavior.

In Table IV are data that provide a basis for comparing the seriousness of behavior tendencies as determined by school-teachers on the one hand and on the other by clinicians whose work consists of helping children who are behavior problems(1). It will be observed at first glance that teachers and clinicians differ considerably on the importance and seriousness of some problems. There is a tendency for the teachers to rate as most serious, behavior involving sex activities, obscenity, stealing, untruthfulness, truancy in the case of one group, and defiance of authority. Teachers tend to take the more orthodox point of view and judge as most serious the more overt misconduct and the tabooed forms of behavior.

Clinicians, on the other hand, tend to rate as being more serious the types of behavior that are less overt and thus are less disturbing. Such behavior, however, is more characteristic of maladjustment and is most apt to lead either to grave individual maladjustment such as psychoses or to extreme antisocial behavior such as crime. These clinicians, who make special studies of problem cases, regard as most serious a child's being unhappy and depressed, suspicious, unsocial, sensitive, and shy. It is interesting to note that profanity seems extremely serious to a group of teachers but not at all important to the clinician. Generally, a pupil with these more significant characteristics does not attract the attention of the teacher by overt behavior of a disturbing sort, as do the defiant and disobedient. The shy, depressed, and unsocial child is the least trouble to the teacher because he is out of the way. He causes no disturbance; hence, the teacher does not sense his maladjustment and his antisocial potentialities; yet to clinicians, psychologists, and other experts in the study of people, such characteristics are very serious.

TABLE IV.—RANK-ORDER ARRANGEMENT OF BEHAVIOR PROBLEMS OF CHILDREN BY GROUPS AS INDICATED\*

| Type of problem                                  | Denver teachers | Mental hygienists | Wickman's teachers |
|--------------------------------------------------|-----------------|-------------------|--------------------|
| 1. Stealing . . . . .                            | 1               | 13                | 1                  |
| 2. Heterosexual activity . . . . .               | 2               | 25                | 2                  |
| 3. Unreliableness . . . . .                      | 3               | 21                | 12                 |
| 4. Untruthfulness . . . . .                      | 4               | 23                | 5                  |
| 5. Cruelty and bullying . . . . .                | 5               | 6                 | 8                  |
| 6. Cheating . . . . .                            | 6               | 24                | 9                  |
| 7. Unhappiness, depression . . . . .             | 7               | 3                 | 22                 |
| 8. Unsociability, withdrawal . . . . .           | 8               | 1                 | 40                 |
| 9. Masturbating . . . . .                        | 9               | 41                | 3                  |
| 10. Suggestibility . . . . .                     | 10              | 8                 | 28                 |
| 11. Temper tantrums . . . . .                    | 11              | 17                | 18                 |
| 12. Obscenity in notes, pictures, talk . . . . . | 12              | 28                | 4                  |
| 13. Destruction of school material . . . . .     | 13              | 45                | 10                 |
| 14. Easy discouragement . . . . .                | 14              | 7                 | 23                 |
| 15. Selfishness . . . . .                        | 15              | 16                | 24                 |
| 16. Impertinence . . . . .                       | 16              | 37                | 7                  |
| 17. Resentment . . . . .                         | 17              | 4                 | 29                 |
| 18. Nervousness . . . . .                        | 18              | 19                | 20                 |
| 19. Quarrelsomeness . . . . .                    | 19              | 31                | 27                 |
| 20. Disobedience . . . . .                       | 20              | 42                | 11                 |
| 21. Domineering . . . . .                        | 21              | 11                | 33                 |
| 22. Impudence . . . . .                          | 22              | 32                | 16                 |
| 23. Laziness . . . . .                           | 23              | 36                | 17                 |
| 24. Fearfulness . . . . .                        | 24              | 5                 | 36                 |
| 25. Carelessness . . . . .                       | 25              | 38                | 25                 |
| 26. Sensitiveness . . . . .                      | 26              | 10                | 48                 |
| 27. Truancy . . . . .                            | 27              | 22                | 6                  |
| 28. Physical cowardice . . . . .                 | 28              | 15                | 31                 |
| 29. Overcritical regard for others . . . . .     | 29              | 9                 | 45                 |
| 30. Sullenness . . . . .                         | 30              | 12                | 35                 |
| 31. Slovenliness . . . . .                       | 31              | 35                | 34                 |
| 32. Suspiciousness . . . . .                     | 32              | 2                 | 37                 |
| 33. Shyness, bashfulness . . . . .               | 33              | 14                | 50                 |
| 34. Lack of interest . . . . .                   | 34              | 26                | 14                 |
| 35. Stubbornness . . . . .                       | 35              | 20                | 32                 |
| 36. Boredom . . . . .                            | 36              | 27                | 10                 |
| 37. Thoughtlessness . . . . .                    | 37              | 30                | 38                 |
| 38. Tardiness . . . . .                          | 38              | 43                | 30                 |
| 39. Inattention . . . . .                        | 39              | 34                | 26                 |
| 40. Profanity . . . . .                          | 40              | 47                | 15                 |
| 41. Inquisitiveness . . . . .                    | 41              | 44                | 44                 |
| 42. Dreaminess . . . . .                         | 42              | 18                | 41                 |
| 43. Disorderliness . . . . .                     | 43              | 40                | 21                 |
| 44. Tattling . . . . .                           | 44              | 29                | 46                 |
| 45. Imaginative lying . . . . .                  | 45              | 33                | 42                 |
| 46. Smoking . . . . .                            | 46              | 49                | 18                 |
| 47. Silliness . . . . .                          | 47              | 39                | 39                 |
| 48. Restlessness . . . . .                       | 48              | 4                 | 49                 |
| 49. Interrupting . . . . .                       | 49              | 48                | 43                 |
| 50. Whispering . . . . .                         | 50              | 50                | 47                 |

\* From ELLIS and MILLER, *Journal of Educational Psychology*, 27: 501-511, 1936.

In a rural school in western Minnesota about two decades ago were two brothers whose characteristics and subsequent careers serve to illustrate the points that have been made. At the time the author taught them, they were in the intermediate grades. They were quiet and reticent, causing no noticeable disturbance. They were not given to the type of mischievous pranks that are really wholesome but are often interpreted by the uncritical as indicating serious problem tendencies. When interviewed, the teacher who had had them in another rural school in the primary grades said that they were her best behaved pupils.

They were not happy, spirited boys, however, but were suspicious and furtive. Moreover, in controversy with their classmates they showed a strong stubbornness. Still, they caused no particular trouble in school. Near the end of the school term, the older boy displayed obstinacy toward his teacher on an occasion when he was asked why he had stayed out of school during the afternoon. He stated that his family was moving out of the community and that he, therefore, was leaving school. Continued discussion brought out a surliness coupled with an obduracy that enabled this pupil to prevail.

In his teens, this boy turned to stealing. His parents were poor, so they did not protest when their boys brought home articles that added to the family possessions. The two brothers of this story developed the practice of stealing groceries from the automobiles and wagons of farmers who were in the village doing their shopping. In their early twenties, they expanded their antisocial activities to include bank robbery. They held up many banks. In a little over a year, they became the desperados of their section of the country. After a number of successful holdups, they were captured, tried, and sentenced to fifty years' imprisonment.

No one would claim that the shy, unsocial, suspicious, and stubborn individual will always develop, as these two brothers did, into an arch criminal. Still, it cannot be emphasized too much that parents, teachers, and club leaders should be vigilant in observing those characteristics which cause a child to be overlooked but which are truly serious symptoms of maladjustment. Nearly everyone can recall some unsuspected person who developed psychoneuroses or who shocked his community by his unexpected antisocial acts. It is said of such persons that

they seemed so quiet and good that no one would have expected it of them.

### SOME GENERAL CHARACTERISTICS OF THE MALADJUSTED

It is well for the teacher to keep in mind certain characteristics that either cause or are associated with maladjustment. A general principle to observe is that the pupil or person who deviates from the normal or average has greater potentiality for maladjustment than the person who is nearly average. In some traits, this principle does not apply so strictly to deviations above the average as to those below it. This point will be made clearer with reference to specific factors and traits as they are further discussed.

**Physical Traits.**—Boys and girls who are very large or very small for their age are likely to develop marked self-consciousness about their size. These feelings may distort their behavior and lead them to adopt defense mechanisms. The person who is somewhat larger than the average may acquire a healthful feeling of superiority, but those who are far above or fall below the average in physical characteristics are apt to reflect in their behavior a consciousness of their deviation. The children that are too tall or too short, extremely fat or extremely thin, who are very unattractive or very attractive will be likely to display in their personality the effect of their physical characteristics. The very attractive girl, for example, may develop airs and a vanity that make it difficult for her to get along with others. Conversely, the unattractive girl will set up defense and escape mechanisms to protect herself. The reader can doubtless recall numerous illustrations of the effect of physical appearance on personality.

**Physical Defects.**—The crippled person, too, is handicapped in getting along; consequently, he often develops an inferiority complex and then manifests compensatory behavior. A child with a clubfoot, a shriveled arm, a hunchback, a scarred face, or a conspicuous birthmark needs a sympathetic teacher who recognizes the effect of such defects on behavior and does everything she can to minimize the handicaps that those defects impose on the afflicted.

Deafness, too, has a definite effect on personality. Fortunately few young people are hard of hearing, as, for the most part,



deficient hearing is not serious until near middle age. The hard of hearing become quite conscious of their defect and have more worries and complexes than do people whose hearing is normal. A marked factor in the behavior of the deaf and hard of hearing is their sensitiveness in a social situation. As a consequence, they tend to retreat from others, a practice that, in some instances, only accentuates their personality difficulties.

**Mental Ability.**—A good portion of the maladjustment in school is caused by deficiency in mental ability or, conversely, extreme brightness. Some may hold the point of view that very low or very high intelligence is associated with maladjustment but is not the cause of it. It seems reasonable to assert, however, that in the school situation, where intelligence is an important factor in interest and success and where interest and success are important for mental health, intelligence is causally related to adjustment. The boys and girls who do not have the mentality to assimilate the intellectual fare that is put before them often develop problem tendencies. It is also true that the child who has such a high mentality that the intellectual fare does not give him enough nourishment also develops problem tendencies. It is not alone the principle that idle hands turn to mischief that may be at the basis of much disturbing behavior but that disturbing feelings and emotional tones are engendered by too easy and too little work. Nevertheless, though very high intelligence may lead to maladjustment in grade school, a little more than average intelligence helps in getting along well. In the upper levels of the school system, high school, and college, considerably more than average intelligence is desirable, and in college it is hardly ever the case that a person will be maladjusted because of too much intelligence.

Closely related to mental ability is failure in school subjects. Of the maladjusted children, as many as 50 per cent and even more fail of promotion, whereas the percentage of well-adjusted children who fail is almost negligible. Poor work habits as well as lack of intelligence account for failure, but all in combination are both symptomatic of maladjustment and causal of it.

**Socioeconomic Status.**—Other factors that contribute to maladjustment are socioeconomic. Children low in the socioeconomic scale develop feelings and attitudes that will handicap them throughout their lives. They are generally neglected by

other children and evaluated in terms of their home surroundings and the clothes that they wear. Poor children are often not invited to the parties of other children and are kept away from many of the school activities, plays, and games that require the purchase of tickets and equipment. At graduation time, they feel conspicuous because their clothes are not so good as those of the other pupils or because they have been unable to buy the class rings, invitations, and other incidentals of graduation.

The child whose socioeconomic status is low is conditioned like the perch who was separated by the glass pane from the minnows. When trying to swim toward the minnows with the purpose of swallowing them, it bumped against the glass pane. After it had been conditioned by the glass pane, the pane was removed, but the perch did not strike at the minnows. Similarly, in the case of the poor children. They have been conditioned by attitudes toward them resulting from their being in a low social stratum. Whenever they have tried to reach out to participate in certain situations, their poverty has imposed a restraint. Even when they become adults and are prosperous, so that the "glass pane" has been removed, still their mental attitudes and behavior are affected by their childhood experience, so that they deprive themselves of privileges that were earlier denied them.

Sometimes children reared in abundance and luxury will also develop feelings and habits that cause maladjustment. Such children may be overpampered, may never have to contend with the difficulties of a situation, and may become conceited. When they are in a situation where they must depend only on their own resources, they cannot cope with it and react by having a temper tantrum, by giving up, or by turning to other escape behavior.

**Study of the Individual.**—Not all extreme deviates are maladjusted, but so many of them are misfits, more or less, that all of them should be observed carefully for symptoms of maladjustment. Those who are modal or near modal in many respects but who either have predispositions toward maladjustment or have been subjected to severely unfavorable conditions may also manifest distorted reactions. It is well, therefore, to anticipate symptoms of maladjustment in the average child as well as in those who have physical, mental, and social characteristics that may cause aberrations in behavior. The problem of the teacher

is to detect maladjustments and try to remedy the situations that cause them. She will have to be vigilant in her study of the children and of the environmental factors that condition their behavior.

### SUMMARY

Mental health refers to emotional balance, and a well-balanced and adjusted person is said to be in good mental health. He is comparatively free from the symptoms of maladjustment listed in the previous discussion. Mental health is preserved by experiencing a considerable amount of success, by being in a friendly and sympathetic atmosphere, by not being overprotected, by developing efficiency through good habits, and by having a well-balanced program of work and rest.

Problems pertaining to the behavior and mental health of children who fail to get along very well with others are not easily solved. Teachers and parents should take an experimental attitude; and if one method does not work, others should be tried. It is necessary to keep in mind that the reserved, shy, timid, and sly child probably is most poorly adjusted and has the greatest potentiality for unsocial behavior. Overt, noisy, and mischievous behavior is often the reflection of surplus energy and is not serious.

Children and adults who deviate considerably from the normal in various traits have greater tendency to be in poor mental health than those who are average. This is especially true if the deviation results in deficiency. Children who are physically handicapped and those who are very small or very large develop a consciousness about themselves that influences their behavior. Children who are low mentally or very high may become distorted in their reactions unless the situation is fitted to their abilities. Children whose low status deprives them of many rights and privileges develop personality traits that reflect their environment.

The teacher should take the point of view that the child is an organism that is sensitive to his environment even though children differ in the way in which they respond to their environment. Some are influenced more than others; but, in general, conditions incompatible with the organism cause undesirable

emotions and behavior, whereas favorable conditions evoke good responses and facilitate effective adjustment.

### Problems and Exercises

1. In terms of success and failure, why are very dull and very bright children in school often unhappy and maladjusted?
2. What methods and practices used in the school do you think have an unfavorable effect on the mental health of the pupils?
3. Describe the characteristics of teachers who you know influence the mental health of children favorably and of those who influence it unfavorably.
4. What are the effects of being tied to the mother's apron strings?
5. Some persons are without system and have no regularity in their daily program; others, on the contrary, are regular and orderly. What effect does a system have on mental health?
6. Discuss whether it is easy or difficult to readjust the maladjusted.
7. What are the weaknesses of a system of order and discipline that is established and maintained by the constant vigilance and control of the principal and teachers?
8. Describe a school, either real or imaginary, in which you think the discipline is ideal.
9. It has been observed that many high-spirited, active boys, well-known for their pranks and mischief, turn out to be the most reliable and effective citizens. Explain in terms of the seriousness of various problem tendencies.
10. What are some characteristics of boys and girls who may be considered as having predispositions to serious maladjustment and antisocial behavior?
11. Discuss the physical, mental, and socioeconomic traits and factors that predispose one to poor mental health and general maladjustment.

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## CHAPTER VII

### MEASURING THE CAPACITY FOR LEARNING

**Directions for Study.**—The discussion in this chapter begins by pointing out differences in the learning capacities of children and then centers on the beginnings of attempts to measure their mental capacities. Both the individual and the group intelligence, or aptitude, test are described.

Learn about the beginnings of mental tests by Binet and Simon and also by Cattell.

Why were the tests by Binet and Simon successful intelligence tests whereas those of Cattell were not?

Two revisions of the Binet scale, the 1916 and the 1937, known as the Stanford Binet, are mentioned, and the 1937 revision is explained in considerable detail. Learn about the nature and characteristics of the latter test.

Learn clearly the meaning of intelligence quotient and mental age, and be able to calculate the mental age and intelligent quotient according to the method presented in this chapter.

The group test is also described, including its history and the nature of its contents. Be able to describe the various types of items in the group test, and indicate the various mental processes, such as reasoning and memory, that are tested by these items.

Learn how norms and standards for a group mental test are determined and also how the I.Q. is calculated.

**Introduction.**—In 1918, over two decades ago, there were in a Minnesota rural school two pupils who stood out by contrast among the 33 who constituted the total enrollment. Anna was six years old, an industrious little pupil who sat in the left outside row, the row for the first graders. Paul was a tall adolescent boy of fourteen who occupied a desk in the other outside row. Paul was only a fourth grader, but he sat in the eighth-grade row because the seats were larger. To that extent, at least, an adjustment had been made for him. The teacher could perceive Paul's

size and consequently help him adjust himself as far as a desk was concerned.

The teacher, however, could not see so definitely the degree of Paul's mental capacity. She knew that he had not been a bright student, because he had spent eight years in school and was still only in the fourth grade. Furthermore, in spite of his age, he was a poor fourth grader.

Anna, on the other hand, was an excellent pupil. She could do a little arithmetic and read aloud unflinching. She grasped meanings well and could explain what she had read. Her parents were aware of her school achievements and felt that she was being well taught.

Paul, unlike Anna, read haltingly. He jerked or bowed his head at many words and appropriately enough, because they were his master. He knew little of what he read and was unhappy when he struggled with the words. His teacher made him try hard and was often impatient. She hoped the time would come when Paul would "wake up" and learn as easily as the other pupils did. Because Paul learned little, his parents thought that he was poorly taught.

If at that time mental tests had been available, and the teacher had acquired the technique of administering them, she might have learned something about her pupils that would have enabled her to treat them more realistically. She would have discovered Anna's mental status in terms of average children and thus understood why Anna was proficient and how rapidly she could be expected to learn. Paul's capacity to learn could also have been determined, and the educational process could have been adapted to him almost as effectively as the seating adjustment. Thus adjustment could have been made to his mental as well as to his physical size.

**The Introduction of Mental Tests.**—Differences in the capacities of pupils and problems arising from these differences have always confronted the teacher. Psychologists and educators recognized the need of an accurate test; and since late in the nineteenth century, attempts have been made to formulate one to measure intelligence. Tests of mental capacity were being composed and revised over 30 years ago. There were no tests that could be given to a group of children simultaneously, but a mental test had been devised for testing one child at a time. A

test that can be administered to a group is called a *group test*; a test that can be given to only one person at a time is called an *individual test*.

**The Development of Mental Examination.**—The first successful examination of mental capacity was devised by Alfred Binet, a Frenchman. He was asked by the school authorities of Paris to work out a method for identifying the dull pupils. The schools were troubled by the retarded children and wanted a system of judging their capacities for doing schoolwork. It should be noted that the tests arose from problems connected with the ability of children to do schoolwork and that it was the retarded children who provoked the inquiry for a measuring instrument.

Binet, with the help of his colleague Simon, worked for over a decade at this problem. In 1905, the two collaborators published their examination, which consisted of 30 separate tests or items. Binet continued to rework and revise this test until his death in 1911. A revision of his scale had been brought forth in 1908, and another in 1911, the year of his death. This last revision included more tests and could be used for testing subjects ranging in age from three years to adulthood.

The present form of intelligence tests is essentially a product of the beginning of this century. The Binet-Simon scale of intelligence was introduced to the United States by Goddard, who translated and adopted the tests for use at the institution for the feeble-minded at Vineland, N. J. Here, again, the test was first used on the retarded, a fact that may account for some of the prejudice against mental examinations in general. The form of test most extensively used in the United States is the Stanford Revision and Extension of the Binet-Simon Scale, which was published in 1916 by Lewis M. Terman of Stanford University. In 1937, another revision by Terman and Merrill was published. Before analyzing this most recent revision, we should consider some of the attempts of the last century to measure intelligence. A knowledge of those attempts and failures will help us understand what capacities the present-day tests measure.

The publication of the original Binet-Simon scale in 1905 was not the first attempt to measure intelligence or the capacity to learn. There had been those before Binet and Simon who had



tried but not successfully. Success in any endeavor always has its antecedents in the attempts of others. Almost every important inventor, discoverer, or creator is preceded by a history of other men who tried to accomplish that which was finally invented, discovered, or created. Similarly in the case of Binet and Simon.

Among earlier investigators was James McKeen Cattell, a distinguished American psychologist of the late nineteenth and early twentieth centuries. Cattell in the 1890's developed a series by means of which he hoped to test mental capacity. Included in his series were tests of quickness in naming 10 colors, of strength of grip, of ability to bisect a 50-centimeter line, of speed of arm movement. These exercises tested sensorimotor abilities but failed to measure mental capacity. Cattell discovered that there was no relationship between the abilities of college students in these tests and their success in college. He assumed that ability in school is a general indication of mental ability and concluded that because the ability measured by these tests did not correlate with school ability these tests did not measure intelligence.

It remained for Binet to develop a scale that was actually a mental test. He set out to test the complex mental powers and not the sensorimotor abilities, as others had done, particularly in the newly established psychology laboratories of that time. Binet devised problems and exercises to test comprehension, memory, power of making comparisons, ability to draw conclusions, reasoning, and other mental processes.

**The Age Scale.**—Not only did Binet find exercises for measuring mental capacity, but he also arranged his tests into a scale of age levels. The difficulty of the individual tests was determined by the percentages of children of given ages who passed a test. Tests passed by 75 per cent of six-year-olds were placed at the six-year level, and comparably for the other age levels.<sup>1</sup> The principle of the age scale as formulated is like that used by Terman and Merrill in their latest revision. Therefore, the study of the Terman-Merrill test in some detail will provide a clear understanding of the individual age scales in general as well as of the last Terman revision.

<sup>1</sup> The percentage of successes for each age group, however, was not always 75 per cent.

**THE NEW REVISED STANFORD-BINET TESTS OF INTELLIGENCE**

The first Stanford-Binet Scale, which was a revision by Terman and assistants of the original Binet scale, was published in 1916(1). This revision has been used extensively for a little over twenty years, and in 1937 the new revised Stanford-Binet tests were issued by Terman and Merrill(2). These appear to be a considerable improvement over the 1916 revision. There are two forms or examinations—Form L and Form M—in the 1937 revision and but one form in the 1916 revision. Thus there are two examinations where there was only one before, so that when a person is retested he can be tested with a different form, and thus the practice effects that accompany the repetition of the same examination can be avoided.

The test has also been lengthened so that it extends from year level II up through superior adult. Because a test must extend below the age level of the average child being tested, it may be said to be satisfactory on the average for persons ranging from age three up through adulthood. For dull children, the test is not so suitable for as young as three, but it is quite satisfactory for those four, five, or six years of age, depending on the degree of dullness. Bright children a little younger than three may be tested by the 1937 revision.

Table V gives a skeleton outline of Forms L and M showing age level, the number of tests at each age level, and the value of each test. In the lower age levels, from year II to V inclusive, there is an extra test, so to speak, which is called an *alternate*. It is used when a test is spoiled or cannot be used for other reasons, as sometimes is the case with younger children. According to this outline, the maximum mental age that can be tested is 22 years 10 months. The number of tests, alternates, and values is the same for both forms.

In order to test a person adequately, it is necessary to find a year level in the examination where he can pass all the tests. For an average child, this level is usually one or two years below the age of the child. Thus, an average three-year-old child will probably pass all the six tests of year level II. A dull three-year-old is not likely to do so; and a very dull one is certain not to succeed with all the tests. On the other hand, a bright three-year-old can probably do all the tests at the three-

year-old level and, if exceptionally bright, can do those even at a higher age level.

**Basal Age and the Calculation of I.Q.**—The basal age has been discussed incidentally but has not been named. It consists of the highest year level where a pupil can pass all the tests. In the case of a child who passes all of year II but not all of year II-6, the basal age is II. For purposes of this example, assume that

TABLE V.—YEAR LEVEL, NUMBER OF TESTS, AND VALUE\*

| Year                     | Number of tests<br>for both Form L<br>and Form M | Value of<br>each test,<br>months |
|--------------------------|--------------------------------------------------|----------------------------------|
| II.....                  | 6                                                | 1                                |
| II-6.. . . . .           | 6                                                | 1                                |
| III. ....                | 6                                                | 1                                |
| III-6. ....              | 6                                                | 1                                |
| IV.. .. .                | 6                                                | 1                                |
| IV-6.....                | 6                                                | 1                                |
| V.....                   | 6                                                | 1                                |
| VI.. .. .                | 6                                                | 2                                |
| VII....                  | 6                                                | 2                                |
| VIII.. . . .             | 6                                                | 2                                |
| IX.....                  | 6                                                | 2                                |
| X....                    | 6                                                | 2                                |
| XI. ....                 | 6                                                | 2                                |
| XII.....                 | 6                                                | 2                                |
| XIII .....               | 6                                                | 2                                |
| XIV. ....                | 6                                                | 2                                |
| Average adult.. .        | 8                                                | 2                                |
| Superior adult I ..      | 6                                                | 4                                |
| Superior adult II.. .    | 6                                                | 5                                |
| Superior adult III . . . | 6                                                | 6                                |

\* 22 years 10 months if all tests are passed.

this child who is three years, or thirty-six months, old passes all six tests of year II, five tests of year II-6, three of year III, two of year III-6, one of year IV, and none of year IV-6. The problem consists of finding first this child's mental age and then his I.Q. The following outline of values can be derived by interpreting the data given in terms of the values listed in Table V.

To find the intelligence quotient, divide the mental age by the chronological age, or 35 by 36. The resulting .97 indicates an

I.Q. that is about average. I.Q.'s are average when the M.A. and the C.A. are equal or nearly so. The M.A. is equivalent to the total value of the tests passed. Each test is given a value in months according to the number at each age level and the value of each level. Some levels, such as the lower ones, II to V inclusive, count 6 months each; years VI to XIV, inclusive, count 12

| Year  | Number of tests passed | M.A. value of each test, months | M.A. value of tests passed, months | Cumulative M.A. value,* months |
|-------|------------------------|---------------------------------|------------------------------------|--------------------------------|
| II    | 6                      | 1                               | 6                                  | 24                             |
| II-6  | 5                      | 1                               | 5                                  | 29                             |
| III   | 3                      | 1                               | 3                                  | 32                             |
| III-6 | 2                      | 1                               | 2                                  | 34                             |
| IV    | 1                      | 1                               | 1                                  | 35                             |
| IV-6  | 0                      | 1                               | 0                                  | 35                             |

\* The total M.A. of this child is 35 months.

months each; and the adult levels count 16, 24, 30, and 36 months, respectively.

Consider the boy twelve years two months old who passes all the tests of year XI, five of year XII, five of year XIII, three of year XIV, two of average adult, two of superior adult I, one of superior adult II, and none of superior adult III. His mental age can be obtained by outlining his performance as was done for the other case.

| Year                   | Number of tests passed | M A. value of each test, months | M.A. value of tests passed, months | Cumulative M.A. value, months |
|------------------------|------------------------|---------------------------------|------------------------------------|-------------------------------|
| XI . . . . .           | 6                      | 2                               | 12                                 | 132                           |
| XII. . . . .           | 5                      | 2                               | 10                                 | 142                           |
| XIII . . . . .         | 5                      | 2                               | 10                                 | 152                           |
| XIV.....               | 3                      | 2                               | 6                                  | 158                           |
| Average adult.....     | 2                      | 2                               | 4                                  | 162                           |
| Superior adult I.....  | 2                      | 4                               | 8                                  | 170                           |
| Superior adult II..... | 1                      | 5                               | 5                                  | 175                           |
| Superior adult III ... | 0                      | 6                               | 0                                  | 175                           |

The basal year is XI, or 132 months, so the values for the tests passed in the other years are added to this value. The total M.

A. of this boy is 175 months, and his C.A. is 12 years 2 months or 146 months. His mental development is equal, on the average, to that of children 175 months old, and it exceeds his age. Therefore his I.Q. is over average. It is obtained by dividing 175 by 146, and the resulting quotient of 1.20 is expressed as an I.Q. of 120 by dropping the decimal point.

**The Nature of the Tests.**—The character of tests varies somewhat throughout the scale from the lowest age level through superior adult. At the lowest age levels, the verbal aspect of the test is minimized by the greater use of objects than at the upper level. At the two-year level, for example, the child is asked to identify a toy kitten, a thimble, a cup, a spoon, a chair, an automobile, a key, and a fork. The use of object material, such as beads, blocks, and other things usually regarded as toys, is obviously more appropriate for young two- and three-year-old children than for adolescents or adults. But at the upper age levels, the intelligence is measured more by verbal and abstract tests than by concrete or object material.

Even though there is a variation throughout the age levels to the extent that the tests are concrete or abstract, there is a similarity that runs throughout the various age levels also. An example of that similarity is found in the exercises calling for the repetition of digits after the examiner has spoken them. For example, the examiner will speak at a rate of about one a second the digits 4, 9, 2, 6 and then ask the subject to repeat them. In the year level of 2 years 6 months, the subject is asked to repeat two digits; and at the highest superior-adult level, he is asked to repeat nine digits. Between these extremes, the tests calling for the repetition of digits occur at several age levels. At a few levels, the subjects are asked to repeat them backward.

Another type of question that appears at several age levels is one in which the subject is asked to respond to pictures by telling the examiner about them. At the lower levels, the subject passes the test if he merely enumerates the objects or persons in the picture. In the level above enumeration, he must describe a picture; and the highest level calls for interpretation. In order to classify as interpretation, the answer must consist of implication and seeing behind the picture, so to speak. In a picture of old men outside a post office surrounding a man read-

ing a newspaper, enumeration would consist of saying men, paper, building, etc.; description consists of saying that the men are together outside the post office looking at the newspaper; whereas interpretation would consist of saying: "The one man has a newspaper that contains very important news, possibly about an election or a war, and he is reading to his friends who have no newspaper; this picture is of a time long ago when there were few newspapers."

In addition, there are pictures in which the subjects are asked to fill in missing parts; to compare pictures of faces and indicate the prettier ones; and to locate the absurdities in pictures, such as the shadow falling toward the sun or the smoke going in one direction and the trees bending in another. Picture tests of this kind vary in difficulty and are placed at age levels according to their difficulty.

Tests of word meaning occur at a number of age levels also. At the five-year level, a child is asked to define simple words like *ball* and *bat*; but at the upper age level, the meanings of difficult abstract words are asked for. In fact, in one of the forms of the 1937 revision, there is a vocabulary test consisting of a list of 45 words ranging from the very easy to the very difficult. This vocabulary test, therefore, can be used over a wide age range to test vocabulary ability. There are also tests calling for similarities and differences in the meaning of words.

Besides the repetition-of-digits test, memory is also tested by reading a section of a story to the subject and noting how much he can recall, by reading sentences of different lengths and asking the subject to repeat them, and by copying a pattern of different-shaped beads that has been shown. Thus, both auditory and visual memory are tested.

There are other kinds of individual test in the Terman and Merrill 1937 Stanford-Binet revision, for example, arithmetic problems, questions on what to do under such circumstances as when thirsty, in danger of being late for school; interpretation of absurdities, such as the soldier saying that everyone is out of step but himself; and proverbs such as "The mouse that has but one hole is easily taken."

Not all the mental tests have been described, but this brief description gives a fairly adequate picture of the general nature of a widely used individual examination in which the various

tests are classified into age levels. The nature of the particular tests in the scale indicates that they test various types of memory, power to comprehend and reason, ability to make associations, and also the extent of knowledge of various kinds.

#### GROUP TEST

Psychologists also sought to develop examinations that would test the mental capacity of a group of persons at one sitting. The individual examination is a satisfactory test of capacity, but it usually takes more than an hour to test a child, score his answers, and determine his level of mental development. It was, therefore, natural to seek a test that could be given to the members of a group all at one time.

About 1915, a number of American psychologists were working on group tests. The entrance of the United States into the World War caused them to utilize these early efforts in preparing a group intelligence test known as the *Army Alpha*, for discovering the mental abilities of conscripted soldiers. Results stimulated the construction of other tests so that within a few years after the close of the war many group tests for children and youths had been constructed. Now we have so many mental tests that hardly anyone is familiar with them all. The most flourishing period for their construction and use was the decade 1920-1929. It was during that decade also that the psychological and educational journals contained the greatest number of articles based on findings obtained from the use of these tests. Although intelligence tests are still used extensively and probably more discriminatingly than ever before, the amount of research based on them has declined considerably. A type of research now in progress is that involving mental examinations given the same subjects several times throughout a comparatively long period of years. Now that psychological examinations have been in use over two decades such research yields valuable data.

**The Exercises in the Group Intelligence Tests.**—There are different kinds of exercises in the intelligence tests. To some extent, they all test mental abilities, but the virtue in having a variety of tests is that a wider range of mental abilities is more thoroughly tested. Accordingly, one is likely to obtain a more adequate measurement of general ability with a variety of tests than with only one.

Group mental tests include exercises for testing the following: knowledge of words or the extent of vocabulary, reading ability, ability to solve arithmetical problems, ability to complete sentences, general information, the capacity for logical relationships, judgment, common sense, etc. Most of the items are verbal in nature, although other kinds are used, such as figures and pictures. The following specimens will illustrate the various kinds of items that are usually found in intelligence or aptitude tests.

### RELATIONSHIPS

**Analogies.**—Various forms of items are used to test ability to sense logical relationships. The first list of items is called *analogies*. The relationship between two concepts is expressed, and the problem is to find from among several words the one that expresses a concept that pairs up with the third one and expresses a relationship comparable to that expressed by the first two items. The following are samples taken from Army Alpha, Miller Mental Ability Test, and Van Wagenen's Unit Scales of Aptitude.

1. bird—sings : dog—1. fire, 2. barks, 3. snow, 4. flag.<sup>1</sup> ( )
2. flying—birds : swimming—1. water, 2. fish, 3. sport, 4. tank.<sup>2</sup> ( )
3. 1. liquid, 2. hard, 3. iron, 4. boat—solid : water—ice.<sup>2</sup> ( )
4. sheepskin—sheep : leather—1. shoes, 2. boots, 3. tanned,  
4. cattle, 5. hides.<sup>3</sup> ( )
5. week—Sunday : year—1. month, 2. September, 3. January,  
4. first, 5. day.<sup>3</sup> ( )
6. winter—season : April—1. spring, 2. month, 3. Easter, 4.  
warm, 5. green.<sup>3</sup> ( )

The first analogy is not very difficult. It is relatively easy to comprehend that *bird* is to *sings* as *dog* is to *barks*, because the bird sings and the dog barks. Observe that the arrangement in number 3 is different from the others. Even though none of these analogies is very hard, still some college students will err on the sixth item. The correct answer is *month*, because winter

<sup>1</sup> From the Army Alpha tests.

<sup>2</sup> From MILLER, W. S.: *Miller Mental Ability Test, Form A*, World Book Company, Yonkers-on-Hudson, 1921.

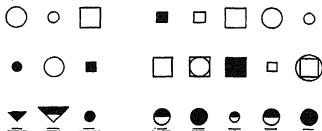
<sup>3</sup> From VAN WAGENEN, M. J.: *Unit Scales of Aptitude, Form A*, Educational Test Bureau, Inc., Minneapolis, 1932.



is a season and April is a month, but some may choose *spring* or *Easter* because it is associated with April. The association or relationships must be consistent and logical, and the ability to detect them is an indication to some extent of intellectual ability.

Analogies may also be expressed as figures and geometric forms. The two samples from the American Council Psychological Examination serve to illustrate this type of analogy. Examination of these will make it clear that analogies of this kind may be devised that require critical and logical analysis for their solution.

Samples



(From "Psychological Examinations," by L. L. and Thelma Guinn Thurstone, American Council of Education, Washington, D. C., 1933.)

**Logical Progression.**—The following items are samples taken from Army Alpha and are characteristic of the numerical series in that test and other psychological examinations. A definite sequence is established by the items, and the person who detects that relationship can supply two additional numbers that will continue the sequence. In this instance, numerical concepts are

|    |    |    |    |    |    |    |      |      |
|----|----|----|----|----|----|----|------|------|
| a. | 2  | 3  | 4  | 5  | 6  | 7  | .... | ..   |
| b. | 8  | 8  | 6  | 6  | 4  | 4  | ..   | .... |
| c. | 1  | 2  | 4  | 8  | 16 | 32 | ...  | .... |
| d. | 12 | 14 | 13 | 15 | 14 | 16 | ..   | .... |

involved, and that is desirable because it prevents a preponderance of verbal and word-meaning items. It may be noted that in the analogies there were items of a verbal nature and those made up of geometrical forms.

A variety in the type of items causes a better sampling of all-round general mental ability. Generally, each aptitude test is organized into parts or sections according to the type and nature of the items. Consequently, a student's special strengths or

weaknesses can be determined by analyzing the scores that he makes on various parts of the test.

**Logical Selection and Classification.**—In the two following items, the problem is to underline for each the two words that express the characteristics that the subject always possesses

1. A WHEEL always has—1. center, 2. circumference, 3. spokes,  
4. tire, 5. wood.<sup>1</sup> ( )
2. A BOX always has—1. depth, 2. hinge, 3. lid, 4. sides, 5. wood.<sup>1</sup> ( )

In the item about a wheel, the correct answers are *center* and *circumference*. Some wheels are disk wheels and therefore do not have spokes; others are without tires; and many are not made of wood. Such items call for reasoning by the elimination of those items which so not satisfy the requirement.

The elimination of a word that does not logically belong with the others is the requirement of these test items. All but one of the items fit into a classification, and it should be crossed out.

1. 1. needle, 2. pan, 3. stitch, 4. thimble, 5. thread.<sup>2</sup> ( )
2. 1. algebra, 2. arithmetic, 3. geometry, 4. history, 5. trigonometry.<sup>2</sup> ( )
3. 1. Anna, 2. Emma, 3. John, 4. Lucy, 5. Sarah.<sup>2</sup> ( )

In the first series of words, all refer to sewing except the word *pan*. In the second series, all the words except *history* are names of mathematical subjects, so it should be crossed out. The problem is one of picking out the term that does not fit into the classification of the other terms.

**Best Answer.**—In a strict sense, the following types of intelligence-test items do not fit into the general heading of logical relationship but are included because they are a test of reasoning and logical analysis. Their solution depends in part, of course, on a knowledge of words and the possession of information, but that is true of many types of items. Intellectual abilities of various kinds are interrelated, and there probably is a core of general ability that underlies the mental capacity that manifests itself in the solution of the various types of problem, aptitude, or intelligence test.

<sup>1</sup> From L. M. TERMAN, *Group Test of Mental Ability, Form B*, copyright by World Book Company, Yonkers-on-Hudson, 1920

<sup>2</sup> *Ibid.*

1. We should "think twice before we speak," because:
  1. We may think of more things to say.
  2. We are then more sure to say the right thing.
  3. If we speak too quickly, we may stammer.<sup>1</sup>
2. Freezing water bursts pipes because:
  1. Cold makes the pipes weaker.
  2. Water expands when it freezes.
  3. The ice stops the flow of water.<sup>1</sup>
3. The saying "A bad workman quarrels with his tools" means:
  1. A bad workman is usually quarrelsome.
  2. If the workman loses his temper, he is likely to break his tools.
  3. A bad workman often excuses himself by blaming his tools.<sup>1</sup>

In each of these examples, one of the three answers is the best, and the individual being examined must reason out why two other possible answers are not so good as the best one.

### INFORMATION

In many psychological, aptitude, or intelligence tests, there is usually a page of items on general information. The assumption is that, on the average, the extent of a pupil's general information is related to his general mental abilities. It is assumed that pupils have enough opportunity to be informed and also that the person with the greater intelligence will seek out more information. It has been demonstrated that scores on an information test correlate with other sections of an aptitude test and also with the test as a whole.

1. A rudder is a part of an 1. automobile, 2. engine, 3. boat, 4. gun, 5. radio.<sup>2</sup> ( )
2. A knot is a measure of 1. electricity, 2. land distance, 3. area, 4. air distance, 5. ocean distance.<sup>2</sup> ( )
3. A trowel is mainly used by a 1. carpenter, 2. plumber, 3. farmer, 4. painter, 5. mason.<sup>2</sup> ( )
4. Church members are organized into 1. parties, 2. denominations, 3. associations, 4. clubs, 5. labor unions.<sup>2</sup> ( )
5. Alfalfa is a kind of 1. hay, 2. corn, 3. fruit, 4. rice.<sup>3</sup> ( )

Some evidence indicates that range of information is influenced more by opportunity and training than are some of the other

<sup>1</sup> *Ibid.*

<sup>2</sup> From VAN WAGENEN, *op. cit.*

<sup>3</sup> From Army Alpha, *op. cit.*

tests. A school can, for example, emphasize training in the acquiring of much general information, and the pupils of such a school might do a little better than they otherwise would. Furthermore, pupils in poor schools are less well trained for such a test than are pupils in good schools.

Added years of living also seem to influence the extent of general information. When tests have been given to adults whose ages cover a wide range, it is discovered that although the scores on some sections decline with age, the scores on the section on general information increase. The increase is not very great, and it may be concluded that the various influences mentioned, such as better schooling and additional opportunities, do not invalidate the value of the information test as part of a general aptitude test.

### VOCABULARY

Knowledge of words is regarded by most psychologists as a valid index to general mental ability. Some psychologists express the belief that the best single indication of a person's general intelligence is the number of words whose meaning he knows. Nearly all aptitude tests include sections on word meaning. Incidentally, word meaning is tested to a greater or lesser degree by all sections that include words in series, sentences, or paragraphs.

Tests of word meaning are arranged in several ways; the following examples show some of the usual forms. In the first two examples words are given, and the object is to select one that means the same or about the same as the first word given. Items are also arranged so the word of opposite meaning is to be selected. Such items are not illustrated here. In some vocabulary tests, series of word pairs are given, and the subject is asked to indicate whether their meanings are the same or opposite. Samples 3 and 4 illustrate that kind.

1. hostile—1. greedy, 2. unfriendly, 3. favorable, 4. strict,  
5. amused.<sup>1</sup> ( )
2. origin—1. beginning, 2. purpose, 3. failure, 4. attempt,  
5. idea.<sup>1</sup> ( )

<sup>1</sup> From VAN WAGENEN, *op. cit.*

|                                        |                                                                                                                   |   |                |        |            |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------|---|----------------|--------|------------|
| 3. exit—entrance .....                 | same—opposite <sup>1</sup>                                                                                        |   |                |        |            |
| 4. agile—nimble .....                  | same—opposite <sup>1</sup>                                                                                        |   |                |        |            |
| 5. 1. many, 2. ill, 3. few, 4. down.   | <table> <tr> <td>&amp;</td><td>&amp; <sup>2</sup></td></tr> <tr> <td>(same)</td><td>(opposite)</td></tr> </table> | & | & <sup>2</sup> | (same) | (opposite) |
| &                                      | & <sup>2</sup>                                                                                                    |   |                |        |            |
| (same)                                 | (opposite)                                                                                                        |   |                |        |            |
| 6. 1. gay, 2. last, 3. long, 4. happy. | <table> <tr> <td>&amp;</td><td>&amp; <sup>2</sup></td></tr> <tr> <td>(same)</td><td>(opposite)</td></tr> </table> | & | & <sup>2</sup> | (same) | (opposite) |
| &                                      | & <sup>2</sup>                                                                                                    |   |                |        |            |
| (same)                                 | (opposite)                                                                                                        |   |                |        |            |

A good arrangement of the vocabulary test is that given by items 5 and 6. In each of the series, two of the words are either essentially the same or the opposite; the object is to select a pair of words of each series that is the same or opposite in meaning and indicate their numbers under the proper heading. This form of the vocabulary test is one of several variations used by various authors.

### ARITHMETIC TESTS

Some psychologists regard arithmetic problems as particularly good elements in an intelligence test, and consequently several tests include a section of arithmetic problems. The following are illustrative, and no comment is necessary.

1. If you walk 4 miles an hour for 3 hours, how far do you walk?<sup>3</sup> ( )
2. A man's income is \$2,000 per year. If he pays  $\frac{1}{4}$  of his money for board, 15 per cent for clothing, and  $\frac{5}{12}$  of the rest for incidentals, how much does he save?<sup>4</sup> ( )
3. A ship has provisions to last her crew of 800 men 4 months. How long would they last 1,200 men?<sup>3</sup> ( )

### SENTENCE MEANING

Two types of this test are presented here. The arrangement illustrated with sentences 1, 2, and 3 provide for underlining either *yes* or *no* to indicate whether or not the subject understands the meaning of the sentences. Sentences of the kind given are good tests of vocabulary ability and to a lesser degree are tests of general information. Obviously, those two abilities are involved in many test situations.

<sup>1</sup> From *Group Test of Mental Ability, Form B*.

<sup>2</sup> From THURSTONE, L. L. and THELMA GWINN THURSTONE: *Psychological Examination*, The American Council of Education, Washington, D.C., 1933.

<sup>3</sup> From Army Alpha, *op. cit.*

<sup>4</sup> From THURSTONE, *op. cit.*

- |                                                          |     |    |
|----------------------------------------------------------|-----|----|
| 1. Are cartoons made by cameras? <sup>1</sup>            | Yes | No |
| 2. Do hobos ever wear dilapidated garments? <sup>1</sup> | Yes | No |
| 3. Are conspicuous objects readily seen? <sup>1</sup>    | Yes | No |

The words in sentences 4, 5, and 6 have been disarranged, and the problem is to rearrange them in the proper order so the truth or falsity of the sentence can be determined. This arrangement represents another variation which helps bring about a more complete and thorough testing of abilities.

- |                                                   |      |                    |
|---------------------------------------------------|------|--------------------|
| 4. north all railroads south and run . . . . .    | True | False <sup>1</sup> |
| 5. pays cautious it be to often. . . . .          | True | False <sup>1</sup> |
| 6. sleepy work is is hard it to when one. . . . . | True | False <sup>1</sup> |

### COMPLETION

Another type of problem generally appearing in the aptitude, or psychological examination is the completion test. This type will be the last to be explained in detail. The examples given here are both verbal and pictorial in character.

*Directions:* Think of the most appropriate word to complete each of the sentences. The number in each space indicates the number of letters in the most appropriate word for that space. Do not waste too much time on any one sentence, as you will be credited with one point for every word correctly supplied.

1. (3) is a fluid material used for writing and printing. \_\_\_\_\_<sup>2</sup>
2. A (7) is a legal dissolution of the marriage relation. \_\_\_\_\_<sup>2</sup>
3. The memoirs of one's life written by oneself are called an (13) \_\_\_\_\_<sup>2</sup>
4. A (7) is a kind of cap used in sewing to protect the finger when pushing the needle. \_\_\_\_\_<sup>2</sup>

The word that will fit into or complete the first sentence is *ink*, and the word for the second sentence is *divorce*. The reader may complete the other sentences.

The completion test is several decades old and has been used extensively in psychological work. It is regarded highly and is used in achievement as well as aptitude tests. In the achievement test, certain key words are left out of definitions and other expressions; the extent to which a subject can fill in the missing words measures his knowledge of the subject. In an aptitude or

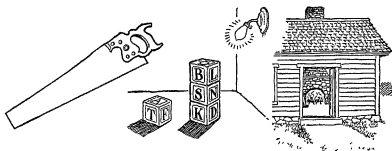
<sup>1</sup> From Group Test of Mental Ability, *Form B*.

<sup>2</sup> From THURSTONE, *op cit*.

psychological test, the items are more general in nature, thus testing general aptitude rather than special knowledge or ability.

The principle of the completion test has also been adapted to pictures. Parts have been left out whose omission the subject must detect and then supply the missing part or parts. The three pictures are examples of the completion test involving pictorial concepts rather than verbal ones.

Some part or element in the picture, necessary to make it complete, logical, or consistent, is missing. For example, the first picture shows a saw without teeth.



(From "*Myers Mental Measure*," by Caroline E. Myers and Garry C. Myers, Newson and Company, New York, 1921.)

The material presented here is not exhaustive but is illustrative of most of that found in psychological tests. In the illustrative material given, the directions test was omitted. In such a test, either oral or written directions are supplied that the subject must observe. In the test involving a series of figures or pictures, the subject is told to draw a line in various ways, such as going over some and under others or back and forth in certain specified ways. Directions may include crossing out a picture and putting a cross or dot under others or at various places. The directions vary in complexity and are given one at a time. The subject must retain the directions in mind while they are being given and then execute them. The direction test is considered a good one and is included in both group and individual mental examinations.

The illustrations given are the materials that are used to test intermediate, upper, high-school, and college students as well as adults in general. Lower grade test material is more pictorial in nature and less verbal. For younger children, the individual mental examination is more satisfactory. The contents of the

most commonly used tests have been described, and the nature of the material used throughout parallels in a general way the content of many tests for the various age levels.

**Intercorrelation of Sub-tests.**—It was pointed out in connection with some of the sub-tests that a common core runs through most of them. Word knowledge, reading ability, and a fund of general information are major elements in this core and are incidentally tested by sections of a test not specifically designed to do so. Because there is a common core running through most abilities, there is a correlation between them. The correlation between two parts of a test should be a moderate one. If it is very high, the two parts are measuring the same capacity and thus constitute unnecessary duplication. If the parts of a test do not correlate at all or correlate very little, they probably do not measure general capacity. It is most desirable for the sub-tests to correlate a moderate amount, because then they do not have the deficiencies just given but measure different phases of intelligence and thus contribute to both the extensiveness and the thoroughness of the composite test. For this reason, the group intelligence test is composed of several different sections that have some features in common but are still unlike enough to test different capacities.

**Norms and Standards.**—A psychologist, in making a test, brings together the items that he thinks are adequate. He gives his test to a comparatively large number of pupils covering the ages for at least most of which he expects the test to be designed. After preliminary experimentation and possibly the giving of the test to more children, he calculates the average scores for children of various ages.

If his test is designed for children ranging from age 5 to 10, he discovers the average scores for children 5 years, 5 years 1 month, 5 years 2 months, 5 years 3 months, 5 years 4 months, and so on up to 10 years. These are called the *norms*, or *standards*, for those ages and indicate the M.A. equivalents for given scores. Let us illustrate with the example of a score of 52, which according to the standards is the average score obtained by children who are 8 years 6 months old. That means that a score of 52 represents an M.A. or mental level of 8 years 6 months. Let us assume further that a child who is 8 years 1 month old obtains that score. His M.A. is 8 years 6 months, and his I.Q. can be obtained by



dividing 8 years 6 months by 8 years and 1 month, which gives an I.Q. of 1.05, or 105.

The I.Q. is calculated for any child the same way. His score on the intelligence test is looked up in the book of norms to determine the M.A. equivalent of that score; and that M.A., in turn, is divided by the C.A. of the child to determine its I.Q. This will be discussed in further detail in the next chapter.

### SUMMARY

Mental tests had their beginnings as effective instruments for measuring mental abilities when Binet and Simon arranged various test items according to age level and published their examination in 1905. Binet devised an age scale by arranging the tests at age levels according to difficulty, and the principle used in the original Stanford-Binet test is used today in the recent revisions. Cattell tried in the 1890's to measure mental ability, but he really tested sensorimotor ability rather than the higher mental processes, and consequently his measurements had little value in discovering general mental proficiency.

The basal age is the highest age level at which the subject can pass all the tests; and during the course of the examination, he is tested until he fails all the exercises of a given age level. The M.A. is determined by adding up the values for all the tests passed; it is then divided by the C.A. to obtain the I.Q. The relationship between M.A. and C.A. gives an index of brightness or the rate of mental growth.

The tests in the recent Terman-Merrill revision of the Stanford-Binet contain both object and verbal material which is graded according to age level from year two up through superior adult. The tests are varied in nature but are planned to measure power of association, memory, reasoning ability, and imagination.

The Stanford-Binet test is an individual test; with it, only one individual can be examined at a time. Group tests were being devised in the teens of this century, about 1914 and 1915; and during the World War, this work was accelerated by the formation of Army Alpha. Following the war, many group tests were devised by means of which numbers of pupils could be tested at one time. A number of the exercises in the group intelligence test are analogies, logical progression, logical selection, general information, best answer, arithmetic, reading, and completion.

Most of these tests are verbal, but some are nonverbal and consist of pictures, numbers, and various geometrical forms. They are designed to examine the various mental processes whose testing is also attempted by the individual test.

Standards and norms are prepared that give the mental level or M.A. equivalent of any given score. The M.A. is divided by the C.A. to obtain the I.Q.—this process being the same for both group and individual tests.

### Problems and Exercises

1. What contribution did Binet and Simon make to the science of intelligence testing?

2. Why did Cattell's tests not work out whereas the tests of Binet and Simon proved effective?

3. Calculate the I.Q. of a twelve-year-old pupil who passes all the tests of year 11, five of year 12, three of year 13, one of year 14, one of the average adult level, and none of superior adult I.

4. Find the I.Q. of a five-year-old child who passes all of year 5, five of year 6, five of year 7, three of year 8, one of year 9, and none of year 10.

5. Describe, in general, the nature of the test items and the mental processes that they are designed to test.

6. Offer any criticism that you have of the content of both the individual and the group intelligence test.

7. It is said of the group intelligence test that it is objective in nature; describe what is meant.

8. Criticise the statement to the effect that the extent of a child's vocabulary is a fairly good index of his general mental ability or learning capacity.

9. The mental age equivalent of a score of 60 is 9 years 3 months. What is the I.Q. of a ten-year-old child who obtains a score of 60?

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## CHAPTER VIII

### INTELLIGENCE AND ITS CHARACTERISTICS

**Directions for Study.**—In this chapter, an attempt is made to describe the meaning of intelligence, to point out the various kinds of intelligence, and also to explain more fully the calculation of the intelligence quotient. The degrees of intelligence and their distribution are also set forth. Intelligence is related to such factors as physical, social, and moral traits. Its growth from infancy to maturity is depicted and described.

Note the general discussion of intelligence, and select the concept that you think most satisfactory.

What is meant by such terms as *power*, *speed*, *altitude*, and *level*?

Observe the evidence indicating that mental or aptitude tests really test some truly basic capacities.

Note the three types of intelligence—*abstract*, *social*, and *mechanical*—and be able to describe them.

Learn how M.A. is determined from an intelligence test and how the I.Q. is calculated.

Be sure that you know what is meant by I.Q.; to know how to calculate it is not enough.

Study the distribution of intelligence, and be able to give the proportion of pupils found in each classification.

If children are very bright or very dull, what are they likely to be physically and also in matters of character?

Describe the course of mental growth from infancy to maturity.

There is little agreement even among psychologists on a definition of intelligence. In a sense, this disparity of opinion is not undesirable, for it allows the expression of a greater number of concepts and includes more aspects. Intelligence has been variously defined as the ability to do abstract thinking, the capacity to learn, the ability to respond in terms of truth and fact, and the ability to adjust to one's environment. Other definitions have been given also, but these are enough to indicate the

range of the definitions. In the field of educational psychology, the definition of intelligence as the capacity to learn is as satisfactory as any. We judge a pupil's intelligence by the quickness with which he can learn and by the amount that he has learned.

The intelligence of a pupil can be measured by the difficulty of the tasks that he can do. Their difficulty is, in turn, determined by the percentage of people in a specified group who can do them. For instance, in the case of twelve-year-old children who are working arithmetic problems or defining words, the easiest problems are those that all can solve, and the easiest words are those that all can define. The hardest are those that none or very few of them can solve or define. The degree of difficulty of such items can be determined by giving them to older children and to adults.

The child who can do more of the difficult tasks or more of those in which most children fail is the more intelligent. The altitude, level, or power of his intellect is determined by the most difficult tasks that he can do. The range, or width, of his intellect is determined by the number of tasks that he can perform at each level. There is a close correspondence between altitude, on the one hand, and width, or range, on the other; the person who has mental power to reach a high altitude of performance can generally do more at each level than a person with a lower level of capacity.

For example, a comparison of those twelve-year-olds who can define words missed by 95 per cent of their age group with those whose limit is reached by defining words missed by 50 per cent of the age group shows that the former can also define more of the words that are missed by only 10 per cent of the twelve-year-olds than the latter can. In other words, those with the higher level of ability can also do better at the lower levels. At such low levels, where the ability to achieve is too widespread to distinguish a child of higher from one of low mental power, those of greater mental power can be discovered by the speed of their performance.

Two very important intellectual factors are power and speed. Power indicates the ability to solve problems, follow directions, memorize, define words, see relationships, integrate a whole out of parts, etc. Speed refers to the quickness with which one can reach the correct solution, define the word, etc. Power and speed are closely related, because ordinarily a person is quick in accom-

plishing tasks because of his mental power, or altitude. A person of high mental power can do most tasks easily and therefore rapidly, but he will do relatively much more slowly the tasks of a difficulty near the limit of his intellectual altitude.

There are some exceptions to the general relationship that speed and power go together. Some children and adults of high mental capacity are deliberative in their nature and are so constituted emotionally that when they are put under pressure to work rapidly they do so very poorly. Speed tests which are often used in school are harassing to pupils of this nature. In fact, it is both psychologically and socially unsound to stress the use of speed—especially unsound in a society that is stressing recreation, and living at a more moderate tempo.

Intelligence is quantitative in the sense that it is measured by the number of tasks that one can do. The child who can define more words and solve more problems than another child of the same age is brighter, or more intelligent, than the latter child. The intelligence test cannot, however, include all tasks, so it contains what its author regards as a good sample of tasks. These ranging from the easy, which all can do, to those which none can do, are arranged to measure adequately a pupil's ability to perform all tasks.

**Measurement of Native Ability.**—Long and heated controversy has been waged over the question whether the abilities measured by the intelligence tests measure true capacity or reflect teaching, educational opportunities, and environmental advantages. According to the latter point of view, a person's ability to read, to memorize, or to define words reflects his training and not his innate capacity. It is, of course, true that many abilities measured by mental tests are largely acquired abilities. There can be little dispute about that. The point that the mental tester makes, however, is that general acquired abilities are in proportion to one's native capacity. What one has acquired is an index to one's power to acquire, or to learn. Thus the extent of one's vocabulary, capacity to comprehend directions, or ability to select the best answer indicates the relative degree of native brightness. Such an attitude implies, of course, that children are assumed to have had the same opportunity to acquire all the abilities tested by mental tests. Ordinarily, it is true that children have enough opportunity; consequently, differences in

performance involving mental concepts reflect fairly accurately the power for acquiring ability, or the capacity to learn, which we may call *intelligence*.

There are differences in the circumstances of life that equip some pupils better than others with the materials included in intelligence tests. Children raised in homes where only foreign languages are spoken are at a disadvantage in a mental-test situation, especially in their earlier years. The richness of their environment often affects younger children. But by the time children have reached the upper grades and high school, the abilities measured by intelligence tests indicate fairly well their capacity for acquiring those abilities

#### MENTAL TESTS AND THE MEASUREMENT OF INTELLIGENCE

The evidence that intelligence tests are valid, or that they test intelligence rather than something else, is derived largely from experiences with school children. The use of mental tests in the school situation has provided us with most of the data showing that these examinations measure a capacity that is very important.

Some evidence of the validity of the mental test is to be found by comparing the ability of the youngest and oldest children of a given grade. It will be discovered that, for the most part, the oldest children in the grade obtain the lowest scores and the youngest obtain the highest ones. Thus in the sixth grade, where the average age is eleven or twelve, the children who are ten years old will score higher than those who are fourteen. Although the older children have had four years' more opportunity to learn than the younger, still they do not have so much mental ability. The principle reason for the differences must be that the younger ones have more native capacity.

Furthermore, success on these tests corresponds with ability in school. The correlation between mental-test scores and success in school as measured by school marks is about .50. Moreover, those who have most ability, according to these tests, continue longest in school. Those who have, on the average, the lowest ability drop out earliest in their school careers. Thus, there is a fairly strong relationship between success in school and mental-test ability.

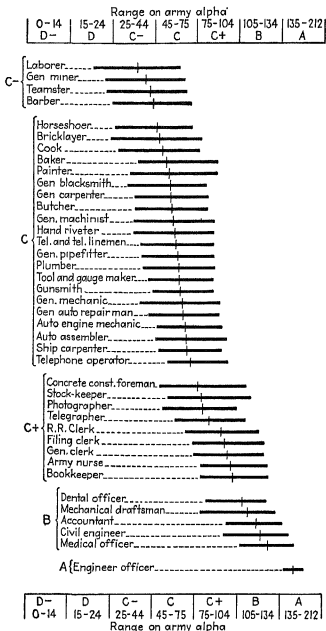


FIG. 5.—Occupational intelligence ratings. Letter grades on horizontal scale. Length of bar for each occupation is midrange of 50 per cent; median point is shown by a cross line. (From *Memoirs of National Academy of Sciences*, Vol. XV.)



There is a positive correlation also between teachers' estimates of the brightness of their pupils and the I.Q.'s of the students as determined by mental tests. The correlation is not perfect, being about .50. Still, it is large enough to indicate to some extent the validity of the tests.

Among adults, there is a relationship between vocational status and ability on these tests. Empirically, we know that the professions call for a higher order of mental ability than unskilled labor. In general, occupations are classified from the professions at one end of the scale to unskilled labor at the other, presumably according to the amount of intelligence needed by the members of those occupations. Examination of Fig. 5 indicates that the order is a logical one, although there is a great deal of overlapping of ability(1).

**Intelligence, or Aptitude.**—Most of the evidence for the validity of intelligence tests is in the form of success in the school situation. Such factors as age in a given grade, school survival and elimination, correlation of mental-test results with school marks, and teachers' estimates pertain to the school situation. Mental tests have proved most useful in the school situation for indicating the aptitude of children for doing schoolwork. Consequently, these tests have been called *aptitude tests*. We speak of those tests given to grade- and high-school students as *school aptitude tests*; and, more specifically, those which are used with high-school graduates and college students are called *college aptitude tests*.

These tests measure well the mental aptitude that a student possesses for doing his schoolwork, but they do not indicate as well what every individual student actually will do. There are many reasons why some students do not achieve so well in school as they are able to. The most common one is that they do not work conscientiously and systematically. They may not be interested, although, in some instances, the fault may lie with the teachers and the school rather than with the child.

On the other hand, some pupils who have low aptitude according to the tests achieve fairly well or better than expected because of unusual diligence and application. Still, one must not charge that the results of the aptitude test indicate nothing because of some inconsistencies between expected and actual achievement. They indicate fairly well the potentialities of the individual

children. The problem of the school is to stimulate and guide children to perform and achieve in accordance with those potentialities. The school will doubtless always fail with some children; but if it tries in many ways to adapt its methods and content to the individual differences in the aptitudes of children, it will succeed much better than it does at present.

#### VARIOUS KINDS OF INTELLIGENCE

**Abstract Intelligence.**—The aptitude, or intelligence, that has been discussed here is an aptitude involving words, numbers, and other symbols. It is an aptitude for learning to read, for working problems expressed in words and symbols, for memorizing verbal material—in general, the intelligence that expresses itself in effective behavior with words and symbols. This type of intelligence is referred to as abstract or verbal intelligence. It is the type most important for success in the learning situation in school, because it is necessary for success in reading, arithmetic, geography, history, and other academic subjects.

**Mechanical and Concrete Intelligence.**—In addition to the abstract, there are other phases of aptitude or intelligence. One of these is the mechanical, or concrete. This form of intelligence refers to aptitude, or capacity, for dealing with situations involving objects or things. The boy who is apt at handling tools, taking a clock apart and putting the parts together, repairing an automobile, finding and replacing a blown fuse probably has a high order of mechanical intelligence. He is successful in solving problems involving concrete, or objective, materials.

Tests have been devised also for measuring motor ability and mechanical aptitude. The mechanical aptitude tests generally consist of assembling the parts of various mechanical devices, such as a mousetrap, doorbell, three-piece clothespin, and bicycle bell. A widely known test of this kind was devised by Stenquist; and the Minnesota Assembly Test by Paterson, Elliot, and others(2) is a revision and extension of the Stenquist test. Mechanical assembly tests have been used quite extensively with school children in connection with industrial courses. The correlation between the ability measured by mechanical assembly tests and general, or abstract, intelligence is comparatively low, indicating that mechanical tests measure a capacity different from that measured by the usual mental test.

**Social Intelligence.**—This phase of intelligence pertains to the capacity to behave effectively with people. A person who can deal well with others has social intelligence. Personality and character traits are closely related to, if not an integral part of, social intelligence. Temperament, disposition, attitudes, honesty, judgment, and humor are factors that are important in determining how well a person gets along with others.

Many persons fail in life because of poor social intelligence. Probably more people fail because of this deficiency than because of inadequate abstract intelligence. Ordinarily, social and abstract intelligence go hand in hand, but there are people relatively high in one and low in the other.

Marion K. was an example of such a person. As a college student, she was a good "grade getter." She had good general intelligence according to mental tests and was regarded as a fine student. Unhappily, her social intelligence was of such a nature that she did not get along well with other girls. She belittled her classmates, manifested an air of superiority, and had few friends. When she became a teacher, her pupils, fellow teachers, and superintendent soon felt that she rubbed them the wrong way. She could not hold a teaching position for more than one year. She purposely developed personal idiosyncracies in order to attract attention. Such means served only to lower her social effectiveness and to throw her farther out of line in making a realistic adjustment.

This girl had adequate abstract intelligence for the making of a very successful teacher. Her I. Q. should have enabled her to become an excellently informed person. But she failed to grow in scholarship as she might have done if she had not been harassed by her failure to get along with others. The personal and emotional effects in her life were the detrimental ones. She had an I. Q. over 120; but her social quotient, so to speak, was under 80.

These three types of intelligence—abstract, motor, and social—although not entirely independent of each other, are still unrelated to the extent that a person may be distinctly stronger in one than in the other. The concepts of these three types or phases of intelligence serve as a general guide for understanding the abilities and characteristics of persons. It is not well to push these distinctions in intelligence too far in their application to

individuals, although a consideration of types of intelligence assists in comprehending more adequately the capacities and characteristics of many individuals.

It should also be mentioned that there are other tests, such as those of musical ability, art appreciation and art ability, neurotic tendencies, vocational interests, honesty, and knowledge of right and wrong. Some of these are of practical value; others are in the experimental and theoretical stages. Even though these tests will not be described, they are mentioned so that the reader may realize that attempts are being made to measure the many interests, abilities, and characteristics of man.

#### MENTAL AGE AND INTELLIGENCE

These concepts have been mentioned in connection with the discussion of the individual mental examination. They will be developed more fully by indicating how the authors of mental tests arrive at standards for determining mental age levels. The author of an intelligence test may assemble and arrange the materials that he wants to include in his test, but he does not have a dependable instrument until he tries it out and establishes norms or standards for it. For example, he must give it to many representative children of the ages for which it is designed in order to discover the average scores for children of those different ages. The average score for six-year-olds will represent a mental age of 6; that of seven-year-olds, a mental age of 7; etc. The author of a mental test generally provides a manual containing norms not only for a range of ages expressed in whole numbers but also for years and months, such as 7 years 1 month, 7 years 2 months.

We can illustrate the procedure for determining mental status by using as an example a child eight years one month old, who was given an intelligence test and obtained a score that is the normal or average score for children ten years two months old. Thus, this child has an M.A. of 10 years 2 months. Knowing his C.A. and his M.A., we can determine his brightness, which is expressed in terms of the I.Q. The formula for I.Q. is  $I.Q. = \frac{M.A.}{C.A.}$ . In this example,  $I.Q. = \frac{10 \text{ years } 2 \text{ months}}{8 \text{ years } 1 \text{ month}}$ , or  $\frac{122 \text{ months}}{97 \text{ months}} = 1.26$ . In calculating the I.Q., it is preferable to

change both C.A. and M.A. to months. The decimal point is usually dropped, and we say that this child has an I.Q. of 126.

The mental growth of this child has been more rapid than average or normal. If it had been just average, it would have equaled the chronological age, and the I.Q. would have been 100. This child, however, has reached an M.A., or level, above his C.A. He has had an average mental growth of more than one year each calendar year. The I.Q. of 126 indicates that he has grown mentally at the rate of 1.26 years each calendar year.

The I.Q. indicates the rate of mental growth of a child. In the example given, the child has lived 8 years 1 month, or 97 months, but has grown mentally at an average rate of 1.26 months per month, or 1.26 years per year. If 8 years 1 month, or 97 months, is multiplied by 1.26, a mental age of 10 years 2 months, or 122 months, is obtained. That is the mental age of this child as indicated originally. In other words, if the I.Q. and C.A. are known, they can be multiplied together to obtain the M.A.

Similarly, we can calculate the I.Q. of a child whose mentality is lower than average. Such a child has an M.A. under his C.A. and an I.Q. under 100. For our problem, we shall find the I.Q. of a girl who is six years eight months old and whose performance on a mental test is equal to that of the average of children five years four months old. Her M.A. is therefore 5 years 4 months, or 64 months. Divide 5 years 4 months, or 64 months, the M.A., by 6 years and 8 months, or 80 months, the C.A.

$$\text{I.Q.} = \frac{64}{80} = .80.$$

This child has grown mentally at a rate that is only about 80 per cent of the average for all children. It has taken her 6 years 8 months to reach a mental level of 5 years 4 months. If her rate of growth, .80, is multiplied by the time she has been growing, 6 years 8 months ( $.80 \times 80$  months), the M.A. 5 years 4 months will be obtained.

As has been said above, the I.Q. indicates the rate of mental growth of children. It expresses the size of the yearly increments that are made to a child's mental level. Furthermore, by indicating the rate of mental growth, the I.Q. may also be regarded as an index of brightness.

An eight-year-old child, for instance, whose mental growth is characterized by an I.Q. of 125 is obviously brighter than one with an I.Q. of 75. The brighter one has the mentality of an average ten-year-old, whereas the duller one is equal to the average six-year-old.

**Children of the Same I.Q. but Different C.A.'s.**—Children may have the same degree of brightness but differ in their ability to learn because they vary in C.A. Obviously, two children eight and twelve years old, respectively, with an I.Q. of 100 are not equal mentally. The older child can comprehend more than the younger, not because he is brighter but because he has lived longer and reached a higher mental level. In four years, the eight-year-old child will have reached the mental level that the twelve-year-old now occupies and will have essentially the same mental ability. Potentially they are equal; and when both of them reach maturity, they will have essentially the same capacity for learning. Thus children of the same I.Q. have the same mental potentiality but differ in M.A. because they differ in C.A.

**Children of the Same M.A. but Different I.Q.'s.**—Children who vary in I.Q. may be found, when measured by the general aptitude or intelligence test, to be of the same M.A. Their scores on the test are the same. Such children vary in C.A. and I.Q. but not in M.A. The younger pupils in this instance are brighter; the older ones are duller. Otherwise, their mental level would not be the same.

For example, an eight-year-old boy with an I.Q. of 125 and a twelve-year-old boy with an I.Q. of  $83\frac{1}{3}$  have the same M.A. Both have reached a mental level of ten, or, in other words, both do as well on the intelligence, or aptitude, test as the average child who is ten years old. Similarly, a ten-year-old child with an I.Q. of 120 and a fifteen-year-old with an I.Q. of 80 have the same M.A.

We may inquire whether or not brighter and duller or younger and older pupils of the same M.A. will achieve equally well if placed in the same grade. The likelihood is that for a short time the older pupil will probably do slightly better in the academic subjects because he has been in school longer and has had more teaching. Furthermore, teaching is usually adjusted to the average and below average rather than the bright. In the

non-academic subjects, however, such as manual training, sewing, and writing, the older pupils will most likely do still better.

Nevertheless, it will not be long before the younger, brighter pupils will surpass the older, duller pupils, especially in the academic subjects. The brighter pupils have higher I.Q.'s and are increasing in M.A. more rapidly than are those of lower I.Q.'s. Therefore, their M.A. will soon be higher than that of the duller children. Then, being brighter and also higher in M.A., the younger pupils will be superior in learning ability to the older pupils. Of course, one can never be certain that the younger ones will actually be superior from the teacher's standpoint, because the older children, in some instances, may work harder and appear to be better students.

The weakness in classification by M.A. can be illustrated by considering what happens when children beginning school are admitted and classified according to M.A. Such a classification is better than the arbitrary chronological grouping that occurs when six-year-old children enter the first grade, but whatever homogeneity of ability is obtained by such a classification does not last long. Let us assume that a few with M.A.'s of 6 have I.Q.'s of 120 and that some have I.Q.'s of 86. According to the illustration, the brighter children are five years old and the duller are seven. Still, for a time they will probably be equally apt as pupils. As they grow older, they will grow apart in their mental capacity. At the end of four years, the mental age of the younger pupil will be nearly  $1\frac{1}{2}$  years more than that of the older one. The brighter pupil will have an M.A. of 10.8 years [ $1.20 \times (5 + 4)$ ], and the duller one will have an M.A. of 9.44 years [ $.86 \times (7 + 4)$ ]. At adulthood, the differences will be even more pronounced, so that if they were then found in the same class the differences in learning ability would be much more apparent.

It can be observed that if both these children were admitted to school at the age of six, they would differ considerably more in M.A. and after a few years the difference would be even greater. At the age of six, the child with an I.Q. of 120 has an M.A. of 7.2 years, and the child with an I.Q. of 86 has an M.A. of 5.2 years. They differ by 2 years in M.A. when they begin school, but eight years later, when they reach high-school age, they will differ mentally 4.8 years, having M.A.'s of 16.8 and 12.0, respectively.

## THE DISTRIBUTION OF GENERAL INTELLIGENCE

There is a wide range in human intelligence. At the lowest end of it are the idiots, with I.Q.'s up to 25, and at the highest are those very precocious persons with I.Q.'s reaching probably 200. Most people have I.Q.'s of about 100 or between 90 and 110. The I.Q.'s of a representative group of children seem to distribute according to the normal probability curve or approximately so. Figure 6 is a normal curve divided to indicate the proportion of various classifications of mental ability distributed according to the normal probability curve.

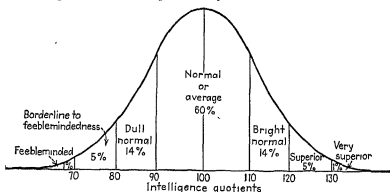


FIG. 6.—Distribution of intelligence quotients.

Those early statesmen of the United States who spoke of everyone's being created equal were apparently not cognizant of the great differences in the mental capacity of people. Equal opportunity, even if it did exist, would not be equally realized because of the basic differences in mentality. An analysis of Fig. 6 reveals the wide range of I.Q.'s, which are generally accepted as an approximate indication of mental ability.

Psychologically, 60 per cent of the people are regarded as average, having I.Q.'s from 90 through 109. There is an equal percentage in the bright normal, with I.Q.'s from 110 to 119 and dull normal groups with I.Q.'s from 80 to 89. Each of these groups includes about 14 per cent of the total. Those with I.Q.'s between 70 and 80, who are classified as bordering feeble-mindedness, constitute 5 per cent of all people and are balanced in number by those with I.Q.'s between 120 and 130 who are classified as superior. Those with I.Q.'s below 70 are classified



as feeble-minded and constitute 1 per cent of the total. At the other extreme, we have the 1 per cent of very superior people with I.Q.'s above 130.

We cannot be absolutely certain that the percentages of each classification of I.Q. is exactly that given in Fig. 6, but the percentages are reasonably accurate and are certainly adequate for practical purposes. It will be observed that as the distance from the mean I.Q. of 100 increases the percentage with the corresponding I.Q.'s decreases. Also, the I.Q.'s a given distance above 100 are equal to those the same distance below the mean. In other words, the I.Q.'s above and below the mean at given distances are equal in number.

**Feeble-mindedness.**—Children with I.Q.'s below 70 are regarded as feeble-minded. They develop mentally at a rate that is less than 70 per cent of the average. Psychologically, they are feeble-minded in terms of the intelligence-test standards for their ages. Some of them are socially adequate if given work that they can do. None of them can achieve satisfactorily if held to the academic work required of school children. They are certain to fail if the teacher holds them to standards of average school achievement.

For example, a third-grade boy with an I.Q. of 65 was a failure according to academic standards. He could not do his arithmetic satisfactorily, and he read poorly. He was becoming a behavior problem of the first order. His teacher reported, however, that he was a most well-behaved and interested child when not harassed with academic subjects. Construction work, machines, and the discussion of outdoor life in the wilds held his interest, and he was a satisfactory school citizen when he could work at less academic tasks so that he would be less handicapped by his low I.Q.

In all probability, the school will continue its attempts to cram academic stuff into his meager learning apparatus, but it will not succeed. The teachers' labors will pay small dividends in an academic sense, and the boy will end as a behavior problem. By the time he reaches adolescence, he will probably be so badly adjusted that the school will give him up with the feeling that it has done all it can for him.

If a child with a low I.Q. has special interests such as this boy has, he should be put in classes that will exercise his abilities

and engage his interests. Some academic material can be introduced incidentally when he is mentally mature enough for it. The child and his adjustment are more important than his academic achievement; he will acquire the few arithmetic or reading skills within his ability much more readily and happily if the teacher waits until he has matured to a higher mental level.

**Degrees of Feeble-mindedness.**—The feeble-minded cover a wide range and have been classified into three groups. Those with I.Q.'s up to 25 are classified as idiots; those with I.Q.'s from 25 to 50 are called *imbeciles*; and the highest order of the feeble-minded are the *morons*. They have I.Q.'s from 50 to 70 and are least distinguishable from the normal group. Fortunately, the number of idiots, imbeciles, and morons corresponds to their I.Q.'s; there are fewest idiots and most morons. In another sense, this trend is unfortunate, for it is the morons and those with intelligence just above the moron level who, as adults, have most children and thereby perpetuate and even aggravate the problem of the socially inadequate.

**Range in I.Q. among the Very Superior.**—There is also a great range in the I.Q. of the upper 1 per cent, whose I.Q.'s are 130 and above. If we consider the maximum I.Q. as being 200, then we have a range of 70 for the upper 1 per cent. This is essentially the range for the lower 1 per cent, or the feeble-minded, whose maximum I.Q. is about 70 and whose minimum I.Q. is nearly 0. A child with an I.Q. of 165 or over is distinctly superior to one with an I.Q. of 130. A child with an I.Q. of 130 is probably the best in 100 unselected children; in a typical community of 5,000 school children, he would be included among the brightest 50. He is not likely to have the highest I.Q., but a child with an I.Q. of 170 might be the brightest of all the 5,000 children.

Chiefly because there is no standard classification, the designations given for the classification in Fig. 6 are not standard. Those for the normal and subnormal are, for the most part, generally accepted, but the designations for the superior and very superior groups are a little different from those of most classifications, because the term *bright normal* was added to balance the term *dull normal* and also to describe those just above the category for normal or average. The term *superior* is used for the next to the highest 5 per cent of the I.Q.'s, and *very superior* for those who

are the best 1 per cent. The designations used are logical and are consistent with the percentages in each of the classifications.

### THE ORGANIZATION OF ABILITIES

**The Very Bright Child.**—Proportionately, there are few very bright children, but in most schools there are one or more. If a school does not have a particularly bright child one year, it may have such a child another year. Very bright children may be described as those with I.Q.'s of 140 and above. It is estimated that there is, on the average, one such child among every 400. I.Q.'s of very bright children range from 140 up into the 180's and 190's. Few indeed are there who have I.Q.'s over 170, and the number with such I.Q.'s is much less than the number whose I.Q.'s are in the 140's and 150's.

Very bright children often constitute a serious problem in school. Especially apt to be maladjusted are the gifted boys. The teacher who is successful in dealing with children whose I.Q.'s are above 140 is to be commended, because teachers fail more in dealing effectively with exceptionally bright children than with any other group.

**General Characteristics of Superior Children.**—Children who are very bright tend to be above the average in other traits also. Rather than being small, nervous, and sickly, they tend to be larger than average, stable emotionally, and in good health. There are many exceptions even among the intellectually gifted, but on the average they are favorably endowed in all respects. A plan of nature is to favor in every way those whom it has favored in one particular, such as high intelligence.

Not only nature favors the intellectually gifted, but nurture as well. Brilliant children are generally born to parents of a higher socioeconomic status. Marked exceptions exist, of course, but the largest proportion are born to parents of good or more than average means. Consequently, they are given better care, consisting of better diets and more adequate medical attention. Furthermore, their habit and emotional training is better. These favorable environmental factors have their effect in developing other desirable attributes.

The bright child is as much a deviate as is the dull one, the former being above the average, and the dull below. He is very

different from the average, but his differences are not so apparent as are those of the children with low I.Q.'s. Negative differences from the average, or deficiencies, make themselves felt more than do positive differences, or strength. The strength of very bright pupils is not so discernible to the teacher as is the weakness of the dull, which reveals itself in every lesson.

As a consequence, the very bright child is left to take care of himself, because he ordinarily does well in his work. If the very bright child does not do satisfactory schoolwork—and some do not according to the usual standards—the mental-test results are regarded as unreliable, and he is treated as a dull child. Such treatment is most unfortunate—the worst that a bright child can be given. It is serious enough when bright children are not recognized and are given a level of instruction suitable only for average children.

Intellectually gifted children, as has been said, tend to be larger and healthier than others of their age, although this superiority is not great, being only an inch or two in height and a few pounds in weight. At about the age when children begin school, the intellectually gifted are probably 4 or 5 pounds heavier than average children of the same age; and at the age of fifteen, they are about 10 to 15 pounds heavier. As indicated before, these differences are not large, but they do indicate the tendency and serve to offset the general compensatory notion that mental strength and physical weakness are associated.

The superiority of gifted children, on the average, in height and weight, especially weight, suggests that probably they are better nourished and consequently are healthier and freer from physical defects. The facts are that gifted children have fewer headaches, are less nervous, have better posture, have clearer skins, are less easily fatigued, have fewer colds, and in general show fewer symptoms of general weakness than do other children.

It must be kept in mind that all mentally gifted children are not superior to all other children in physical characteristics, emotional stability, and social adjustment. In fact, some are below average in these particulars, and a few of them are considerably below. Each gifted child must be studied individually to determine his status. If a person has one desirable trait, he is more apt to have other desirable traits. If a person has an undesirable trait, his other traits are likely to be undesirable also.

In other words desirable traits characterize an individual's endowment, or undesirable traits tend to go together—rather than strengths and weaknesses in the same person. There are many exceptions, and each child cannot be classified according to the trend or a principle based on that trend but must be evaluated individually.

If children are selected because they are particularly gifted in intelligence and studied for other traits—physical, social, and moral—it will be found that they do not rank so high in the other traits although usually above average. Similarly, if we choose a group of children who are the better one-half or best one-fourth or one-eighth, because of their health and physical traits, it would be discovered also that they are above average on the whole in mental ability and social adjustment. However, they will be far from as high in their mental and social traits as in their physical traits, which, in this instance, were the basis for selection. In general, children as a group are not so high in other traits as the trait in which they are very superior or by which they are highly selected, but they tend to be above the average in other traits also.

**The Inferior Child.**—Children who are inferior mentally tend to be under average in other respects also. If, for example, a group of mentally inferior children were selected, say, with I.Q.'s below 50, it would be discovered that physically, socially, and morally they would tend to be below average. They are relatively higher, however, in these traits than in their mental traits. Obviously, for instance, children with I.Q.'s under 50 usually have a physical development beyond their mental development, and their motor skills are above their academic and mental skills. Even though their motor abilities are above their abstract abilities, so to speak, still the former tend to be below the general average for all children of their age.

The mentally deficient tend to be smaller in size and less robust than average and superior children. Inspection of a room of intellectually subnormal children will reveal that fact. They tend to be more nervous and more fatigued and have headaches more frequently than other children. They are under average physically, although their physical status is considerably above their mental status. Relatively these deficiencies are not overcome by the time adulthood is reached.

Similarly, those who are low mentally tend to make poorer social adjustments than children of high mental capacity. Delinquents, for instance, are distinctly below average in mental capacity. There are, of course, delinquents who are above average, and some of very high measured intelligence. The modal, or average, I.Q. is probably in the middle or high 80's. The proportion of delinquents with I.Q.'s under 70, or those who may be considered feeble-minded, is several times as large as the proportion of feeble-minded among an unselected group of children.

**Ability and Character.**—In his study of gifted children, Terman also compared them with an unselected group on the basis of test results of selected character and personality traits. The tests were tests of honesty, trustworthiness, social attitudes, character preferences, and emotional stability.

In these tests the gifted girls and boys showed much better standings than did the unselected group. Still it must be remembered that the gifted children are much brighter, and possibly they masked their true character by giving the answers that they know to be right rather than those which reflected their true character and motives. In other words the character and personality tests may be to some extent tests of intelligence. If the tests are valid, however, it may be assumed that the character traits of the gifted children are more desirable. This is interesting because the common opinion is that intelligence and delinquency go hand in hand.

Has it not been said that if a crime has been committed within 60 miles of Boston, particularly a crime against property, you may be sure that it has been done by a graduate of Harvard University? Reference is commonly made to the brilliant shy-sters, the smart crooks, and the clever swindlers. A brilliant man is often considered dangerous because he will utilize his intelligence to defraud his fellow man. The honest man is often pictured as having a subaverage intellect and being an unimaginative plodder.

The facts show that character and intellect tend to go hand in hand. There are some bright, able men who commit crimes, particularly fraud; but more crime and delinquency are attributable to the adults and children under average in intelligence.

Boys of high intelligence are frequently thought of by their contemporaries as being feminine, or "sissies." It is believed that they like girls' games and do not care for the sports engaged in by red-blooded boys but would rather read books or play the piano. We usually associate vigorous sports, such as school athletics, with boys who have hardly academic ability enough to remain eligible to compete in such activities.

Gifted boys, as a matter of fact, have about as much interest in "red-blooded" games as have unselected boys. On the other hand, it should be recognized that intellectually superior children have considerably more interest in activities more or less related to school. They especially like to read; and younger girls, in particular, like to cut, color, draw, and paint. This is entirely natural for intellects of high order. Still, the intellectually gifted children are as interested in games and physical activities as are the run-of-the-mine children.

In general, it can be said that desirable traits and characteristics tend to accompany each other. There are many exceptions, of course; but more often than not, intelligence, integrity, health, and other qualities tend to be found in the same person in less than average, average, or more than average amounts. Thus a person tends to have a corresponding status in the various traits.

#### GROWTH OF INTELLIGENCE

In connection with the discussion of the I.Q., it was assumed that mental growth proceeds at a rate determined by it. Thus, if a child has an I.Q. of 90, then .90 of a year will be added to his mental development until mental maturity is approached; similarly, a child with an I.Q. of 150 will have added 1.50 years annually. Such a point of view may seem unduly deterministic and raises questions about whether or not a child has the same I.Q. or degree of brightness throughout his years of growth and development.

**Constancy of the I.Q.**—In other words, is the I.Q. of a child constant? A comprehensive analysis indicates that the degree of a person's brightness is fairly constant(3). Those with low I.Q.'s in early childhood will always have low I.Q.'s; those who are average will remain average; and those who are superior will remain superior. The I.Q.'s of half the children will not vary

over 5 points. In other words, if 100 children who were tested and found to have I.Q.'s of 100 were tested at a later date, 50 of them would have I.Q.'s between 95 and 105. One-fourth, or 25, would be over 105; and one-fourth, or 25, would be under 95. A very few might have varied as much as 15 or 20 points, although such a difference is not common.

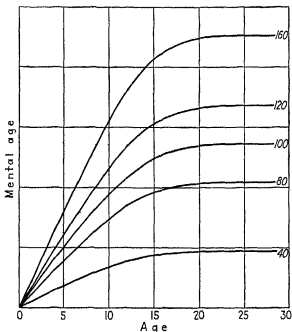


FIG. 7.—Mental growth according to intelligence quotient.

Variation in measured I.Q. may not be caused by true changes in basic intelligence. A number of factors other than fluctuation in capacity may cause those changes. The mental test itself is not completely accurate and will measure a little differently on different occasions. The person taking the test may also differ a little from time to time in his efforts and effectiveness in dealing with the elements of the test. The tester may depart from the standardized procedure, and errors may be made in scoring. Other environmental factors also may enter in. Some pupils may have been raised in a family or community where a foreign language is spoken. If tested in the preschool period or in the primary grades, they would have been penalized on verbal tests



by the language handicap; but such children will score higher when the language handicap is overcome. These and other factors may cause the performance on intelligence tests to fluctuate even though fundamental mental growth proceeds at a fairly steady rate.

On the basis of careful investigation, and after making allowances for the influence of various factors, we may conclude that intelligence develops steadily at a rate determined by the I.Q. Thus, people develop to various levels at a steady rate according to their individual brightness.

Figure 7 depicts the mental-growth curves of individuals with different I.Q.'s, the lowest being 40 and the highest 160. The curves are begun together in the lower left-hand corner, separating more and more with time. In other words, the distance between people of different abilities increases with age. It will be observed that the growth is most rapid from birth up to the ages of ten or twelve. With the beginning of the teens, mental growth slows down; and it reaches its maximum around the age of twenty. The difference in the speed of growth can be noted by giving tests to five-, six-, and seven-year-old children and also to children of thirteen, fourteen, and fifteen. One will find that the differences from year to year in the younger group are much greater than those between ages in the older group.

The curves represent averages for a number of children rather than for individuals. Curves representing individuals of various I.Q.'s are not so even but instead show more fluctuation.

**The Age When Mental Maturity Is Reached.**—We are not certain at what age, on the average, maturity is reached. Thirteen, fourteen, fifteen, sixteen, and up to and including twenty have been variously advanced as the ages after which the intellect does not continue to develop. During the World War, American soldiers who were tested on the Army Alpha showed an ability equivalent to that of school children with a mental age of 13 according to the Stanford Binet. On the basis of that fact, it has been concluded that, on the average, no mental growth occurs after thirteen. The other ages have also been set forth as the year when mental development stops, because various investigators have found no increase in average scores by subjects of that age and older. Increase, however, has been found by investigators to continue past ages sixteen and seventeen. More

recent studies of adult mental abilities indicate that there is some growth up to the early twenties.

It is doubtful that, on the average, all mental growth ceases at thirteen, fourteen, fifteen, or sixteen, as has been contended. There is no doubt that it is much slower at those ages. The growth from fifteen to sixteen is much less than that from five to six. But it seems most likely that complete mental maturity is reached at about the age of twenty. There are those who reach mental maturity before twenty, and some who reach it after that age. Conceivably, individuals who are decidedly deficient mentally reach their highest point of mental development in their early teens, so that decline has set in for them before they are twenty.

The curves in Fig. 7 indicate that the age when mental maturity is reached varies according to I.Q. Those who are dullest mature earlier and at a lower mental level than the brightest, who develop a little longer and, of course, reach a much higher level. The differences, however, in the length of time that bright and dull children continue to grow intellectually are less important than the rate of growth as indicated by the I.Q. The curves indicate that the dull never catch up, in spite of popular opinions to the effect that they do. In fact, they fall farther behind.

#### SUMMARY

Probably a satisfactory definition of intelligence is capacity to learn. The altitude of a person's intellect is determined by the difficulty of the tasks that it can do, and the power of the mind is determined accordingly. Speed, however, refers to the number of tests of any given difficulty that a person can do within a specified time.

Mental or aptitude tests measure the various abilities of persons and thereby give a fairly valid index to the basic mental capacity. These tests indicate best, of course, what students can do in the school situation or any situation involving verbal and abstract abilities.

In order to enlarge our concept of intelligence, a general definition and description of three types have been set forth; these are the abstract, the social, and the concrete. Sometimes the abstract is referred to as general mental ability; and the concrete as motor, or mechanical.

Intelligence quotient is the ratio of mental development to chronological age and indicates the rate of mental growth. Children differ a great deal in their rate of mental development; and consequently children of the same chronological age differ in their mental age, or mental level.

Most children are average in brightness, 60 per cent of them having I.Q.'s between 90 and 110. The dull-normal balance the bright-normal. Those who are borderline to feeble-minded balance the superior, and the number of feeble-minded is approximately equal to the number of very superior. The feeble-minded, in turn, are divided into three groups—the idiots, of lowest intelligence; the imbecile, the middle group; and the morons, who are the highest.

Very bright children are those with I.Q.'s above 130 or 140. More often than not, they are above average in physical ability, and their interest in red-blooded activities is at least average, even though their greatest interests are in reading, music, and other activities that may be described as being intellectual in nature. Children who are inferior intellectually tend to be under average in the various desirable traits and interests that have just been mentioned. The relationship between desirable traits, in the one instance, and undesirable, in the other, is not very high, but there is a tendency for desirable traits to accompany each other and also for undesirable ones to go together.

Intelligence grows most rapidly up to age ten. Less annual growth occurs from ten to fifteen; and from fifteen to twenty the growth is still less. When the age of twenty is reached, mental maturity has probably been achieved.

### Problems and Exercises

1. Select the concept of intelligence that you think most adequate, or devise one of your own.

2. The great mathematician, inventor, or philosopher has ideas that have occurred to very few people. What terms do you use to describe his mind?

3. Discuss whether or not you believe that in the usual school situation the reading ability, vocabulary ability, amount of general information, ability to work arithmetic problems, or other comparable abilities are a fairly good index of a person's real capacities.

4. What lines of reasoning are used to establish the fact that general aptitude, or intelligence, tests actually measure a basic capacity?

5. Give illustrations of social intelligence; of concrete, or motor, intelligence.

6. Define again the terms *mental age* and *intelligence quotient*, and indicate what is meant by mental level, index of brightness, and rate of mental growth.

7. Illustrate how two children, one four and one-half years old and one seven and one-half, can have the same mental level.

8. Discuss whether or not a six-year-old child and an eight-year-old child can have the same I.Q.

9. Discuss whether or not Abraham Lincoln was right when he spoke of God's loving the common people because He made so many of them.

10. Discuss whether or not the present balanced distribution of intelligence is a desirable one from the educational and social point of view. What changes do you think would be desirable?

11. A boy said, "I wouldn't want to be very bright because then I would be more likely to be sickly and nervous." Comment.

12. How do the traits and characteristics of intelligence, character, health, leadership, and social abilities tend to accompany each other?

13. When is mental growth most rapid, and at about what age does it reach its limit?

14. A child obtains a score of 79 on an intelligence test, and an examination of the standards indicates that this represents a mental age, or level, of 10 years 4 months. What is the I.Q. of an eight-year-old child who obtains that score?

15. A six-year-old child obtains a score that has the M.A. equivalent of 4 years 9 months. What is his I.Q.?

16. A seven-year-old child has an I.Q. of 90. What is his M.A.?

17. A child nine years two months old has an I.Q. of 85. What is his M.A.?

18. Make a table showing the M.A.'s of six, seven, eight, nine, ten, eleven, and twelve-year old children when the I.Q.'s for each age are 70, 90, 100, 110, 130, and 150.

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## CHAPTER IX

### LEARNING ABILITY, SCHOOL SUCCESS, AND THE ADAPTATION OF INSTRUCTION TO INDIVIDUAL DIFFERENCES

**Directions for Study.**—In this chapter, discussion centers on the relationship between measured general mental ability and general success in school and more specifically on success in various school subjects. In trying to predict success in school, it is pointed out that the standards change from kindergarten up through the upper reaches of the college and university.

Because of the great differences in the capacities of school children of the same chronological age, instructions should be adapted to individual differences; various methods are discussed.

Note the value of a person's intellectual status in determining what he is likely to do in grade school, high school, and college.

Observe, also, the value of knowing a pupil's general mental ability for predicting what he will do in the various school subjects.

Be prepared to give the reasons why it is possible for students to succeed in some schools and not in others. Learn why other tests besides general intelligence tests should be used.

Learn what is meant by *homogeneous grouping*, *individual instruction*, *enrichment*, and the *contract plan*.

The query whether instruction should emphasize the development of a person's weak points or the development of his strong ones is also discussed.

By using mental tests, one can judge with greater accuracy what school success can be expected of the child. Furthermore, one can predict in a general way what final vocational status a child will reach. If a child is carefully tested when he begins school, his success in terms of school subjects and grade progress can be anticipated considerably better than if no tests were made. In order to obtain a more reliable basis for predicting the degree of success, it is well to retest children occasionally—possibly

every third year or so. Subsequent tests may overcome a part of the unreliability inherent in the testing of children before they have had school experience.

If a first-grade teacher has the I.Q.'s and M.A.'s of her pupils when they enter the first grade, she has data that will help her anticipate fairly accurately what they will do in reading and arithmetic, for example. Not all those who are highest in the mental test will be highest in reading and arithmetic, and not all who scored lowest on the mental test will be poorest in reading or spelling. A general trend is shown, however, which may guide the teacher in what to expect from her pupils both individually and as a group.

**Relationship between Intelligence and Achievement in School Subjects.**—So many correlations have been calculated between intelligence and school achievement that those relationships are fairly well known. A summary of the findings indicates that the correlations between intelligence and all school subjects are not the same. The relationship between measured intelligence and general attainment in grade, high-school, and college subjects has, however, been fairly well established. In the more academic subjects, in which the verbal symbolic elements are predominant, for example; in reading, composition, history, arithmetic, English, algebra, and foreign languages, the correlation within a given group or grade is generally between .40 and .50. Both smaller and larger correlations have been found, but, on the whole, correlations between .40 and .50 are typical.

The correlation between mental-test ratings and skills such as those involved in the mechanics of arithmetic is lower than that for arithmetic problems. Between the drill and mechanical phases of all subjects and intelligence there is less relationship. The intelligence tests indicate most accurately what a pupil will do in the more academic phases of a subject, so to speak.

Intelligence tests indicate less well what pupils will do in art, drawing, and writing. Investigators have found correlations that differ a little; but, on the average, the correlation between mental-test results and ability in those subjects is only about .20. This correlation is low, and on the basis of this relationship a teacher can hardly predict whether the bright child will write, draw, or do art work better than an average child or an average child better than a dull child. From their content, it is

to be expected that the abilities measured by intelligence tests have less in common with the abilities needed in these skill subjects. The intelligence tests are more verbal, whereas these subjects call for more nonverbal abilities.

Similarly, in case of industrial subjects, such as woodworking, mechanical drawing, sewing, cooking, the relationship between attainment in those subjects and mental-test ability is low, being about .20 also. If, in addition to stressing skills and performance, these courses also consist of definite subject-matter content to be learned by the students, the correlation between mental ability and achievement in the courses will be higher, probably as high as .40.

The value of mental tests as a basis for anticipating the achievement of pupils depends to a considerable degree on how accurately achievement is measured. If school marks are used as the criterion of achievement, then it is impossible to predict accurately, because such marks are themselves inaccurate. When achievement is thoroughly measured by carefully devised tests, then the correlation between mental-test ratings and achievement will be higher and, consequently, can be predicted more accurately.

**Correlation between Mental-test Ratings and General School Success.**—We are interested in knowing what pupils in grade school will succeed in high school and what high-school students will succeed in college. To about the extent that correlation exists between I.Q. and ability in the academic subjects there is also a correlation between I.Q. and scholastic success in high school. This is entirely consistent, as scholastic success in high school is determined by success in the individual subjects. In general, there is a correlation of .40 to .50 between I.Q. and high-school achievement. About the same correlation exists between scores on college aptitude tests and achievement in college. The college aptitude tests, if they consist largely of vocabulary items or verbal elements, indicate better what a student will do in general academic courses than in, for example, the college of engineering or the college of dentistry. The school marks that have been obtained in high-school mathematics and science have been found a good indication of what a student will do in a college of engineering.



In fact, the marks that a student has earned in his high-school courses should be considered in connection with the results of the psychological examination when predicting probable success in college. High-school marks are a slightly better indication of what a student will do in college than is his standing in the psychological examination. The school marks that one has obtained, if they are truly earned on the basis of achievement, show what one has done and, therefore, indicate what one is likely to do, though it must be borne in mind that standards of achievement are higher in college than in high school. Aptitude tests indicate what one should be able to do. Thus a combination of what one has done and what one can do provides a good basis for predicting what one will do.

Very few students who have a record of poor marks and who score low in aptitude tests succeed in college. On the other hand, as we should expect, those who have a very good high-school record and have a high rating on the psychological tests, with only a few exceptions, succeed in college. It is harder to predict for those who are high in one respect and low in another than for those who are consistently high or low in both their school marks or their mental-test standing. There is a general positive relationship between success in a higher level of school with previously earned school marks and ratings in psychological tests. Except for the students extremely low or high, it is hard to predict whose scholarship will be satisfactory, because many of this large middle group fail, and many maintain an adequate scholastic record. Of course, more who have been above the average in the tests stay above in scholastic achievement, and more below the average remain there, but a surprisingly large number in both groups do not maintain their relative position. In other words, a considerable number do not live up to expectations, and many exceed their former standings.

It has been found through experience that boys who graduate from high school with a composite ranking in scholarship and psychological tests that places them in the lowest one-third of high-school graduates should hardly attempt university work, because so very few of them succeed. Failure is almost certain for such students. In the case of girl graduates, those in the poorest one-fourth are almost certain to fail.

At the other end of the range, those students who are in the best tenth, according to a combined ranking of their aptitude or psychological test and high-school marks, are almost certain to do satisfactory college work. Very few failures will occur among the students in this highest tenth. From the highest ranking high-school graduates to the lowest, the probability of success accompanies the rank, being best for the best rank and diminishing with a decrease in rank and being least for those with the poorest scholarship and aptitude standing.

**Expectation according to Correlation of .40 and .50.**—It is difficult to visualize what is meant by correlations. We know that one of .40 is larger than one of .20; and in general we judge the amount of correlation by the numerical size of the coefficient, although this is a gross and only an approximate way of doing it. This point will not be developed fully, but an idea of what correlations of .40 and .50 are will be explained by indicating what it means in terms of prediction. Let us assume that we are trying to judge what high-school graduates will do in college if the correlation of combined high-school record and aptitude test with achievement in college is .50. Of those who are above the average on the basis of the combined rating of scholastic and aptitude tests, two-thirds will also be above the average in college, but one-third will be below. In other words, out of every 100 high-school students above the average according to this method about 67 would be above the average in college, and about 33 will fall below. Correspondingly, of students going to college who are below the average for combined ratings of high-school marks and college aptitude, two-thirds will be below the average of college achievement, but one-third will change their position and be above. Thus, if one were predicting in relation to the average, he would be right twice as often as he would be wrong. If one predicted according to guess or chance, he would be right once to every time he is wrong, but prediction on a basis of a correlation of .50 results in a 2-to-1 ratio of correct prediction.

On the basis of a correlation of .40, the prediction is not so accurate. Of those in the upper half, 63 out of 100 will retain that general position; but 37 will fall below, the ratio being 63 to 37, or 1.7 to 1. For a correlation of .50, the ratio was 2 to 1. According to a correlation of .40 between two traits or qualities, of those in the lower half in one trait, 63 out of 100 will be in the

corresponding, or lower, half in the other trait, but 37 will be in the upper half. When the coefficient of correlations is smaller, the ratio of those in the corresponding half to those in the other half approaches 1, or 50 to 50, which is the case when the correlation is zero. As the correlations become larger, or approach 1.0, the ratio of the numbers in corresponding halves to those in the other halves approaches infinity, or 100 to 0. When the correlation is 1.0, all are found in corresponding halves; but when the correlation is zero, 50 per cent are found in corresponding halves, and 50 per cent are not.

**Change of Standards from Kindergarten through College.**—Will a child that does good work in the lower grades do good work in high school and in college? This raises the problem of long-range prediction. An attempt will not be made here to answer the question but merely to point out that prediction must take into account that the average quality of students in high school is higher than that of grade-school pupils and that college students, in turn, average higher than high school. The reason for the increase in intelligence according to school level is caused largely by the retardation and dropping out of the less capable students. The more capable tend to survive and finish high school, and the most capable finish college. This is true only as a general principle, because some who are capable drop out before they reach or finish high school, and many who are mediocre complete their high-school work. The very poor do not finish high school, and comparatively few of the mediocre finish college. Thus, those who finish high school are a more selected group than are those who finish grade school, and those who finish college are a more selected group than those who finish high school. College graduates, in turn, are more selected according to aptitude than are high-school graduates, and the most capable students of all are those who work for advanced degrees. Selection goes on all the way from the kindergarten to the doctor's degree.

It is this selective character of education that helps to explain why some children who seem superior in the lower grades turn out to be only average or slightly better in high school and probably poor or failures in college. For example, a first-grade child with an I.Q. a little over 100 and superior home advantages may, if earnest and diligent, do very good work in the grades. Such a child, if he possesses an I.Q. of 110 or 115, may seem to be the

brightest child in his class. When this child reaches his last year in high school, there will probably be in his classes a few pupils considerably brighter than he. Especially is this true if the high-school classes are large; it is less true in the smaller high schools. This pupil who seemed bright in high school will not be so outstanding in college. He may be only average or even less, because he will be competing with the best students from many high schools. The pupils' relative standing shifts as they proceed up the educational ladder, because the average intellectual quality increases.

**I.Q. and School Level.**—Usually, it may be assumed that the average I.Q. of children in any of the lower grades is about 100. This varies, of course, in any grade or school, according to the socioeconomic status of the children's parents and other factors. If the average I.Q. of children in the lower grades is about 100, it is a little higher in high school—probably about 105 or 110—because the poorest students do not go to high school. It must be recognized, however, that education is not so selective now as it was a few decades ago. More and more students are found in high school, many, because of the tremendous increase in enrollment, with lower I.Q.'s than formerly. College enrollments also have increased very much during the past two decades, and the consequences of these increases is that more of the poorer students are also found in college. The best students in high school and college are as capable as were the best students decades ago, but more of the poorer students survive than formerly. The point should also be made that financial ability to go to college is a more important factor than ever before, so that often financial rather than mental ability determines whether or not a student goes to college.

Owing to the conditions indicated above, it is more difficult now to indicate what I.Q. is necessary for success in high school and in college than formerly. The high school has enlarged its curriculum and offers so many different types of courses that most students can now obtain a high-school diploma. Such an adjustment to individual differences is desirable, because the school serves the pupils; but it also means that high-school diplomas do not represent the same kind and quality of scholarship that they did years ago.

Ordinarily, it is expected that high-school students should have I.Q.'s of at least 105 or 110 in order to grasp the content of most high-school subjects. Higher degrees of brightness are desirable, of course, and students with higher intelligence acquire a better comprehension of their subject. It is doubtful, however, that children whose I.Q.'s are under 105 can understand adequately the use of symbols in algebra or the interpretation of the facts in history, acquire the vocabulary in Latin or the principles of physics, or comprehend the abstract and symbolic elements in most scholastic subjects.

The minimum I.Q. for satisfactory college work is higher—possibly 110 or 115. College students with less intelligence drop out in large numbers, although a few of them do creditable work because of their extraordinary industry. In order to be able really to comprehend college instruction, to integrate the subject matter acquired, and to react in a somewhat original way to it, a higher I.Q. is needed, possibly 125 or 130 and over. One cannot be too arbitrary about minimum I.Q.'s, as there are always the exceptions in the case of those who are low down in the group but achieve suprisingly well in spite of a mediocre intellectual equipment. In general, however, it is well to recognize the limitations set by I.Q.'s of different size, with a willingness to allow for exceptions.

A striking exception was the case of a boy with a low college aptitude who entered college. The aptitude tests that this young man took when he entered the senior division or the upper two years of college indicated that he was in the lowest 5 per cent of all students who entered. It was predicted by those who did not know him that it was futile for him to try to obtain a college degree. "He might just as well go back home and not even begin his courses," said an instructor who observed his standing.

Those who knew his school history stated that he had a good high-school record, that he had done well in junior college, and that he had characteristics and capacities that the aptitude tests do not measure. On the basis of past performance, it was predicted by those who knew him that he would do acceptable work during his junior and senior years.

The boy did do passing work. In fact, it was strong average. Conversation with him near the time of graduation revealed that

he was disappointed because his marks were not high enough to earn for him a place on the honor roll. He had tried very hard to be on the honor roll, but apparently he could by studying very diligently and systematically succeed only in passing his courses satisfactorily; with his limited aptitude, even his most earnest attempts to achieve superior standing resulted in failure.

Ordinarily, it is said of students of this type that they are hard "pluggers" and will do passing work but that nothing creative or original can be expected of them. The boy we have spoken of exceeded all expectations in this regard also, as he took out a patent on an invention shortly after he graduated from college. His invention did not alter appreciably the way people live, but it represented a degree of creativeness not found in many with much higher I.Q.'s.

This case, of course, is an exception and must be regarded as such. Most students with his aptitude rating fail. A few exceptions should not cause us to overlook the general trend or relationship between aptitude and school achievement. Still, we should be on the lookout for exceptions and remember that none of life's activities can be reduced to a formula.

**I.Q. and School Subjects.**—Some subjects require more of the ability measured by aptitude tests than do others. These are the ones more academic in nature. In the elementary school, as has been stated, reading, arithmetic, history, geography, language, and grammar call for the abilities measured by general mental tests to a greater extent than do art, writing, or music. In high school, the more academic subjects such as Latin, algebra, geometry, English, history, French, and physics require more of the abstract type of intelligence than do the commercial and vocational subjects. Thus, it is discovered that students taking Latin and those who select an extra unit of mathematics, for instance, are brighter than those who specialize in agriculture, sewing, cooking, typewriting, bookkeeping, or manual training. The I.Q.'s of students taking these latter courses may be 10 or 15 points lower than those taking the classical, scientific, or general subjects. Thus, the various types of courses attract students of different abilities.

Sometimes teachers attribute the greater mental ability of the students in their courses to the training value of the subject itself. For example, when a Latin teacher in a high school of 160 pupils

discovered that her students had the highest mental ability, she pointed out to her superintendent the effect that the study of Latin had on their mentality. The true reason for the superiority of the Latin students is that Latin is chosen by students who have more of the ability that the mental tests measure. Students who take Latin tend to come from homes in which the parents have had an academic education and who plan that their children shall go to college. Furthermore, the weaker students are not encouraged to take Latin, and the consequence of these factors is that the better students are found in the Latin classes.

In trying to anticipate who will succeed in school, the teacher should take cognizance of the change of standards, previously mentioned, that occur from kindergarten up through the graduate school, because of the dropping out of school by the weaker students or the survival of the strongest. Thus, a child may have more than adequate ability for the first grade but not for the high school or college. The quality of the student body becomes more select and improves from year to year, making competition at different levels increasingly difficult for all students; only the better ones succeed in high school and, more especially, in college.

Still, it should not be overlooked that students have special interests and abilities and that if they are not so able in general academic work, they may be better in music, art, vocational subjects, physical education, and other studies more specialized in nature.

**University Departments and Measured Aptitude.**—The average mental aptitude of students in various university departments and colleges also differs. Generally, the graduate students have decidedly the highest average aptitudes. Engineering, law, and medical students usually test high also. These students are ordinarily well selected, as the courses require a high order of academic or abstract ability, which is the ability measured most adequately by the aptitude tests. Students in the music school, agricultural department, home economics courses, and school of dentistry tend to have the lowest mental ability of the kind that aptitude tests measure. This is not surprising, as students are in the music school because of their musical talent first and their academic abilities second. Although the training of a dentist involves a considerable amount of content or book mate-

rials, still, much of the success of a dentist depends on skill and dexterity with his hands and with tools. Thus, dental students are selected in part on the basis of abilities other than those measured by aptitude tests. The students in the colleges and departments mentioned do not have such high psychological test abilities on the average as have those of other departments; yet they probably have higher special abilities and interests than the academic or scientific students have. Nevertheless, they would be better students and would rank higher in their chosen profession if their academic aptitudes were higher. It should be added, in order to avoid misunderstanding, that we have been speaking in terms of averages. On the basis of academic measurements, there are brilliant and exceptional students in any department or school and consequently in all professions and vocations.

#### Differences in the Capacities of Students in Different Schools.

The average capacity of school children in any large school system differs from school to school. The mental-test scores of the children of a school in one section of a city may be distinctly higher or lower than those of a school in a different section. Figure 8 shows the differences in the mental abilities of the children in a number of schools(1).

This figure indicates the variation among 64 schools in mental-test scores according to the percentage of each school above and below the limits of the middle 50 per cent of all the 6A children. For purposes of illustration, we may single out schools 37 and 45. About 57 per cent of school 37 and 0 per cent of school 45 are above the upper limit of the middle half of all 6A pupils of all the schools. Those above this limit are at least equal to the best one-fourth of all students. Below the middle half, the percentages are very different for the two schools. Only about 14 per cent of the pupils in school 37 are below the middle half and may be classified with the poorest one-fourth of all pupils, but about 75 per cent of school 45 are in that category. The status of the other schools can be interpreted similarly.

The schools with the children whose measured aptitude is higher are situated in good residential districts. Most of the parents are successful professional and business people, and their socioeconomic status is high. Their families tend to be small or moderate in size. The children of this district have had the





advantage of a richer home environment and also have probably inherited better intellects.

The school with children of lowest mental aptitude is situated in what is generally described as a district of poor homes. The fathers of the children in this school are unskilled or semiskilled laborers, and unemployment is common among them. Their socioeconomic status is low, and the cultural and educational influences of the home environment are meager. Furthermore, it is likely that the hereditary endowments of many children in these areas are also below average.

The teachers in the school situated in the more favored district will find that their children are above the city norms or medians of achievement tests for various subjects, whereas the teachers in the school located in the less favored district will discover that their children are below the city medians. The latter teachers may try as hard as they can, but it is doubtful that their pupils will, on the average, reach the city norm. It is very difficult for the teachers in school 45 to bring their children's performance up to the city median and practically impossible to bring it up to the level of performance of school 37. The latter is almost certain to be above the city norm no matter how poor the teaching. Some supervisors may commend the one school for its fine achievement and point out to the other that it is not up to standard. If, however, the average mental ability of the schools is taken into account, no one should expect the poorer school to come up to the average achievement.

Variation in the quality of the student body may also characterize the schools within the county or state and the nation. Children vary with areas which, because of social and economic conditions, attract a superior type of people or a poorer type as the case may be. In suburban and residential areas, for example, the quality of the students is likely to be high; whereas in mountainous, cut-over, or congested slum areas, the quality is likely to be lower. The socioeconomic status of an area is a general index to the general mental abilities of the students from that area.

**Variation among Classes of the Same School.**—The quality of the student bodies of even the same school may differ from year to year. It happens that during a given year the quality of the class may be higher or lower than it was the previous year; and

this is especially true if the enrollments are small. This point was brought out when the supervisor from the state department of education was visiting a small village school and called the attention of the superintendent to the fact that not so many high-school students passed the state examinations as formerly, implying that the teaching had become poorer. The superintendent, however, showed the state inspector, in the mental-test results, how the mental capacities of the classes varied from year to year. He pointed out that in schools where the enrollments are small, comparatively large increases or decreases in the proportion of duller or brighter pupils occur from year to year and the proportions of failures are apt to vary accordingly. The superintendent added, in his defense of the increased ✓ number of failures, that the effectiveness of instruction or the instructional standards of a school cannot be judged on the basis of the number who fail in the state examinations without taking into account the mental capacities of the pupils. The argument given by this superintendent of schools is a valid one.

The variation found from school to school within a large city or from village to village is also found in various colleges throughout the land. Large differences exist in the qualities of students. In some colleges, the best quarter of the students are equal to only the poorest quarter of other colleges. This means that in some colleges essentially all the students are equal or superior to the best one-fourth of the students in other colleges where the average mentality is low.

In spite of such facts, colleges whose students are so different in their abilities are similarly accredited and give the same degree. The degree cannot, under such conditions, represent the same levels of achievement. In fact, good scholarship in the colleges with the poorer students might be considered failure or, at best, just passing in the colleges that attract the best students. These statements apply particularly to the colleges with student bodies that are extremely poor or extremely good, intellectually, but they are applicable in lesser degrees to those colleges in which the differences are not so great. Even though colleges differ in the quality of their student bodies, ordinarily the best students of most colleges are very capable and make satisfactory graduate students in almost any university.

### ADJUSTMENT TO THE INDIVIDUAL DIFFERENCES IN INTELLIGENCE

Except for those with very low I.Q.'s, children of all mental abilities are found in the schoolroom. The children who enter the first grade at the age of six are heterogeneous in ability. A first-grade child with an M.A. of four may be sitting next to one with an M.A. of eight. They are given the same assignments and are required and expected to do the same work.

In previous years, and to some extent today, the process that resulted in more homogeneity of ability in the class was the promotion of the bright pupils and the retardation of the dull. Some children remained in the same grade three or four years. As a result, those who reached the upper grades were considerably more homogeneous in their capacity to profit from instruction than the first-grade children had been.

Now the policy of many schools is not to fail children so frequently as formerly. As a consequence, the dull children are promoted regularly; and when they reach the intermediate and upper grades, they are, comparatively, even less competent to do the work than they were in the first grade. Figuratively speaking, the work in subsequent grades grows farther and farther away from their reach. But no matter what the promotional policy, the instructional problems because of individual differences always exist.

**Homogeneous Grouping.**—Attempts to divide children into homogeneous groups are not new. In fact, it has been attempted as long as we have had group instruction. Our present system of organizing children into grades—first, second, third, etc.—is an attempt to classify them according to their ability to learn. One should ask if the present grade system based on chronological age is the best. It has some advantages, but there are many weaknesses in it also. Children of the same C.A. differ in physical size, ability to adjust socially, in I.Q., M.A., and the capacity to comprehend the instruction that they receive. For instance, they differ so much in achievement from grade to grade that some fourth graders have more skills and knowledge than some eighth graders, and there are first and second graders who exceed a few of the fourth graders. The achievement of the best one-fourth of any grade is distinctly better than the poorest one-

fourth of any grade next above it; and among the upper grades of a school, the achievement of the best one-fourth of the pupils is better even than the poorest one-fourth of the class two grades above it. Thus, if the best one-fourth of the sixth grade replaced the poorest one-fourth of the eighth grade, the quality of the eighth grade would be improved and become more uniform.

By applying our knowledge of individual differences and using intelligence and achievement tests, we should be able to grade, or group, pupils more effectively than they now are grouped. It is clear that when pupils are grouped according to C.A., there is marked heterogeneity in their social maturity and their ability to profit from instruction.

If children are to be classified according to ability, what ability or abilities should be of major importance? Possibly the capacity for learning as indicated by I.Q. and M.A. should be regarded as a very important one. Teachers' marks, with all their inaccuracy, do indicate in a general way just how effectively a pupil achieves and what a child has done, and I.Q. and M.A. indicate reasonably well what a child can do. Standardized achievement tests likewise indicate how well a child has achieved and also indicate how well he will achieve in the future. It may be well to consider first the methods of classification based on these measures before others are taken into account.

Children of essentially the same I.Q. and M.A. may be put into the same class or group. They will have about the same degree of brightness and the same mental level. In addition, they will be of about the same age also, because if they are similar in I.Q. and M.A. they will be similar in C.A. In fact, the way to make sure that the children in a group will be homogeneous in M.A. is to select those of the same C.A. and same I.Q. It is, of course, impossible in the practical situation to choose children of exactly the same I.Q. Because I.Q.'s range continuously from low to high, it is a good practice to group those between given points. For example, children eleven and twelve years old with I.Q.'s between 90 and 110 can be put in one group. To select from within this range the brighter younger child and the less bright older child and group them together is desirable. Thus, a twelve-year-old child with an I.Q. of 100 will fit fairly well in a group with an eleven-year-old child with an I.Q. of 110, because both have an M.A. of about 12. There will always

be some variation within any group selected for homogeneity, but a small range is allowable.

Accordingly, children of a given age can be divided into two or more groups. Practical considerations, such as the number of pupils to be classified, may govern the number of groups. They might be divided into as few as two or as many as five or six groups.

Theoretically, pupils classified into groups so that they are fairly uniform in I.Q. and M.A., and thus in C.A. also, should be able to learn with about equal facility. They should grasp directions and explanations at about the same rate; and their intellectual progress should be nearly uniform.

**Achievement and Capacity.**—What should theoretically take place and what actually takes place are usually not the same. It is probably true that not much variation in the ability to perceive and comprehend will be found. Still, there will be variation in achievement, as children differ in the degree to which they work up to capacity. Even in a group of children with superior intellects there will be found those who do poor work. On the other hand, a few children will appear in the dull group who will achieve much better than expected; and in the average group, some will be above the norm of the superior group, and some poorer than the average of the dull group. All this is especially true in terms of the teachers' opinions of their pupils' work. If comprehensive achievement tests are given to the members of the various ability groups, it will be found that achievement follows the expected level more closely than the marks of the teachers indicate.

In view of the fact that actual achievement does not always correspond to the capacity to comprehend, the question may be raised whether or not children should be transferred to other groups according to their achievement. Thus, should a student who achieves high for his capacity be shifted to a higher or abler group, or should one who achieves poorly in terms of his capacity be transferred to a group of pupils whose aptitudes are lower? It is doubtful that achievement, especially as determined by school marks, should influence the classification to that extent. The unreliability in marks is so great that they cannot be made the sole criterion by which to judge a system of classification. Children should be classified according to their ability to compre-

hend the instruction as well as according to the teacher's judgment of classroom performance.

We can illustrate with the case of John P., a bright boy with an I.Q. of 146, who was in the sixth grade of a large junior high school. Most of his marks were C or average, but he did receive some D's and an occasional F. When measured by standardized achievement tests, however, it was discovered that his achievement was three to four grades above his grade placement. In the school that he attended, he was placed in the group of average ability because of achievement. In addition to being unsatisfactory in achievement as judged by the teacher, he was also a behavior problem.

But in spite of his marks, he should have been placed in the brightest group. His brightness and his powers of comprehension fitted him for that group. It is doubtful that his work would have become any better in the poorer group, as he would not be likely to prepare the required papers or lessons any more adequately than formerly or show any more interest in recitations. In fact, he was placed in a remedial section, an unforgivable educational sin, and he did more poorly than ever, as he was bored by drill and repetition. If he had been placed in a class where the teaching was of a level that stimulated bright children to react, he might have developed an interest in the class material.

Faulty placement affected not only his marks but his personal adjustment, and his behavior tendencies became more serious. This increasing maladjustment was to be expected as long as he, a boy with an I.Q. of 146, remained in a group where the instruction was directed toward pupils with I.Q.'s of 100 and where his companions—possibly his teacher also—were intellectually inferior to him. If he had been placed in the brightest group, the likelihood is that he would have made a better adjustment, especially if the teacher of that group were bright and had adapted the curriculum and her teaching to the capacity of her students.

**Ability Grouping and Specific Subjects.**—If students are classified on the basis of I.Q. and C.A., and thus incidentally M.A. also, they are classified according to their general mental capacity. It will be found that students classified into different groups on this general basis are not uniform in their ability to learn the various school subjects. A few in the brightest group, for

example, might not be so apt in arithmetic as in the other subjects. They might profit more by the instructional methods used in another group where the general intelligence is not so high as in the group in which they are classified. Similarly for other subjects. Children of average or lower groups who have a special ability that enables them to be particularly strong in a given subject might profit by taking instruction in their strong subject with a brighter group. Assigning pupils from one ability section to another for specific subjects will not be necessary in very many cases, because, in general, their abilities in the academic subjects are reasonably uniform; that is, they tend to achieve in all of them at about the same level.

Abilities for such special subjects as art, music, and physical education do not correspond so closely to the general mental level as do those for academic subjects. Thus, homogeneous grouping by I.Q. does not classify the students so effectively for the special subjects as for the general academic ones; but it is somewhat better, even for these special abilities, than no classification at all.

There are many schools where it is almost impossible to classify the students according to their measured mental abilities. This is especially true in many small schools where the numbers are so small that it is impracticable to divide them into ability groups. In rural schools, however, where the enrollments are comparatively small but the grades for the individual school and teacher often embrace all eight grades, effective reclassification into fewer and more homogeneous groups or grades can be achieved by the use of general intelligence and comprehensive achievement tests. In other instances, where it is unworkable to classify children into ability groups, adjustment to differences in capacity can be made by adapting the methods of instruction to the capacities of the pupils.

#### ADAPTATION OF INSTRUCTION

Out of the extensive testing of abilities has emerged a sharpened interest in individual differences in capacities and abilities of people. This interest has taken practical form in the school in attempts to adjust instruction to difference in capacities and abilities. Various methods have always been used, such as individual attention after school, special homework, summer



school, tutoring, remedial work, and extra promotion. A method that has been a more direct outgrowth of the psychological testing has been the classifying of pupils so that they can be taught according to their capacities to learn.

**Ability Grouping and Suitable Instruction.**—Ability grouping should be a means for bringing about effective instruction for children of all abilities. Obviously, in a heterogeneous group, instruction directed to the dull is not suitable for the average and the bright, and instruction suitable for the bright is not adapted to the average and dull. Consequently, when children are classified into ability groups, the content of the courses and the method of instruction should be adapted to their learning capacities. Bright children need much less drill and will respond to teaching that leads them to interpret and relate what they learn. They will profit from a method permitting them to work independently, exercising their own initiative and originality, and a method causing them to integrate larger portions of their knowledge than they can if the classroom method is merely the question-and-answer type.

Children of less aptitude need more direct help from the teacher. Though deadening to the bright pupils, drill, frequent reviews, and frequent testing are more effective for the dull. The degree to which the teachers adjust their teaching methods depends, of course, on the degree of dullness of their pupils and the nature of the subjects. There are, for instance, phases in the teaching of arithmetic that require more drill and review than is necessary in history or geography. Or, again, there may be more need for intensive work in teaching a subject in its initial stages than is necessary later on.

Teachers, supervisors, principals, and superintendents must do their part to make instruction with ability grouping most effective. There is no point in classifying children according to their general aptitudes if educators do not plan beforehand how they will adjust their methods of instruction and the curriculums to the characteristics of the groups. Once the plan is put into operation, changes and adjustments may be made as the need arises.

It is important to select teachers according to their abilities to teach the children of the various ability groups. Some teachers are best fitted for dull children and work patiently and

effectively with them. Others have the imaginative quality, sweep of mind, and special capacity for stimulating bright children.

An example of good classification but poor subsequent control is to be found in a junior high school of over 1,000 pupils where the children were classified into five ability groups on the basis of I.Q. and M.A. The classification was worked out by the school psychologist, after which the principal assigned the teachers to the respective groups. The teachers followed the course of study as before and taught much as they had previously, except in those cases where circumstances forced them to make some adjustments. The teachers of the brightest groups found it easy to cover the material; the achievement of their pupils was high. But those who had the poor group labored hard to cover the course of study for their grade, and the achievement of their pupils was low. Many of the teachers in this school, and the principal also, were not satisfied with ability grouping and felt that the former heterogeneous classification was probably just as satisfactory and saved the work of organizing the students into homogenous groups.

In this instance, it was not the principle of homogeneous grouping that was at fault but the psychologist, the principal, and the teachers, who failed to function according to the opportunities offered by the ability grouping. In the first place, the psychologist should have explained to the principal and teachers just how the children had been grouped and just what this grouping implied as to teaching methods and curricular changes. After this had been done, the principal should have taken charge in planning with the teachers and the psychologist how the curricular content could be adapted to fit the aptitude of the different groups. Furthermore, the problem of teaching methods should have been taken up, perhaps concurrently with the discussion of the curriculum. Then the teachers would have been ready to make the most of the situation after they had begun their work with the different ability groups.

Even when ability grouping has once been established, continuous study of the arrangement should be maintained so that beneficial adjustments can be made. Some pupils will probably have to be transferred from one group to another, and no doubt some of the teachers should be shifted about so that they will

teach the groups for which they are best adapted. The teacher of the bright groups will be faced with the problem of having enough books, references, and materials for enriching the curriculum. The teachers of the dull also need special materials. Only if an experimental attitude is maintained and adjustments are made as the need arises can the effectiveness of ability grouping be truly determined.

**The Results of Ability Grouping.**—It is difficult to evaluate the effects of ability grouping, because it has been given so few adequate trials according to the principles just set forth. The main purpose of ability grouping, as indicated above, is to adjust teaching methods and curricular content to the differences in children's aptitude for learning. As this purpose has not yet generally been realized, it is difficult to draw any conclusions. The most we can say at present is that there is some evidence that children tend to achieve better in homogeneous groups.

That fact is probably important, but it must be even more important to know what effect ability grouping has on the personality of children. Are they better adjusted when segregated into fairly homogeneous groups, or do personality difficulties arise from such a classification? Theoretically, they should be better adjusted. When children are grouped so that they are faced with tasks commensurate with their capacities, and when they are in a classroom with fellow students not much poorer or much better than they, they are not hopelessly outclassed by their fellows, defeated by too difficult tasks, or dulled by too easy ones. The effect of ability grouping on the mental health of pupils is not known, but attempts should be made to discover and evaluate it.

Analysis made of results indicates that probably there are, on the whole, slightly superior achievements and better personal adjustments in the ability groups(2, 3). It must be admitted, however, that the evidence is far from adequate.

That we do not have adequate evaluations of the effectiveness of homogeneous grouping is a good reason for giving it a thorough trial. There is apparently virtue enough in the plan to warrant its being carefully tested. Ability grouping is not new, having been practiced, nominally at least, in many schools since shortly after the introduction of group mental tests. A natural consequence of the mental testing of children was to classify them

according to ability. But because of practical difficulties, the practice is less common in the smaller schools. In schools with enrollments over 250, homogeneous grouping is practiced much more extensively. About three-fourths of the schools the country over having over 500 pupils practice ability grouping.

**Individualized Instruction.**—Some schools may use a method of teaching that enables the pupils to learn at their own individual rate. This system requires specially prepared instructional and test materials. The instructional materials are arranged into units so that the child can master the contents with a minimum of help from the teacher. Accompanying the study materials are self-testing exercises which enable the pupil to determine how well he has mastered the part of the subject that he has studied. When he has reached a satisfactory standard of efficiency as determined by examination over a unit of work, he is permitted to begin another unit.

The progress of pupils under this plan is influenced by their industry and learning ability. In addition, the individual pupil can adjust his program of study according to his abilities to progress in the different subjects. A pupil who finds himself better in one subject than another may strengthen himself in his weaker subjects by spending more time on them and less time on his strong subjects. A young pupil in a school in Winnetka, Ill., where the individualized system is practiced, said, "I don't have to spend much time on reading. I can read a page by just glancing at it, but I'm not so good in arithmetic, and therefore I put more time on it."

The individualized method of instruction tends to emphasize the acquisition of the basic facts and skills in various subjects. It is doubtful if the pupil by that system alone gets adequate opportunity to apply those facts and skills to life situations, as he might if he were learning through activities or in a socialized situation. At Winnetka, however, half the day is spent in socialized activities, and the other half in individualized work. Groups of children engage in pageants and plays, group singing, excursions, the arts, handicrafts, and creative writing. In addition, the students have their own government, which also operates to socialize pupils. By means of such a combined program, the children have an opportunity to relate their information to group life.

**Differences in the Individual.**—Even though each individual in a broad way tends to be uniformly endowed, still he is stronger in one respect than another. He may have greater ability in one academic subject than another, or he may have special talent or interests in mechanics, art, or music. The question arises, therefore, whether one should spend more time on his weak subjects in order to bring his achievement in them up to average or should develop his strongest subjects at the expense, or at least a partial neglect, of his weaker subjects.

For the most part, teachers practice the method of drilling the pupils on their weak subjects. If a pupil is especially strong in history and weak in arithmetic, he is directed to spend more time on arithmetic and less on history. There are good grounds for questioning that procedure, because a pupil probably should not neglect his strength in order to cultivate his weaknesses. If a person has a special interest in a subject because he has more ability in it than in others, he should work at it more rather than less. The teacher and librarian should provide him with more books in the field and be alert in calling his attention to lectures, movies, exhibits, and other opportunities for sharpening his interests, widening his knowledge, and developing his critical attitude toward the fields of his special ability.

Much extra time devoted to the pupil's weaknesses is probably not well spent. The extra time is better used if spent on the subject or subjects of his greatest interest. He may develop a proficiency in a field of study that he will pursue all his life. It is better to develop children and adults so that they are especially strong in some fields of knowledge and comparatively weak in others rather than uniformly mediocre in all. This point of view should be interpreted in general to apply to larger areas of ability and not to specific weaknesses within a given subject. If, for example, a pupil is weak in certain basic steps in arithmetic, then drill should be centered on that weakness and not on the steps that have been mastered. On the other hand, if there are some pupils particularly good in the manual arts and mediocre and uninterested in a few required academic subjects, then emphasis should not be placed on learning those subjects to the partial neglect of the non-academic subjects in which he is interested. If there are subjects for which the pupils have an aptitude, schools should never be too arbitrary about requiring subjects that, for some pupils, are overly distressing.

A quotation from Dolbear will illustrate the evils in a system for uniform development(4).

In Antediluvian times, while the animal kingdom was being differentiated into swimmers, climbers, runners, and fliers, there was a school for the development of the animal.

The theory of the school was that the best animals should be able to do one thing as well as another.

If an animal had short legs and good wings, attention should be devoted to running so as to even up the qualities as far as possible.

So the duck was kept waddling instead of swimming. The pelican was kept wagging his short wings in the attempt to fly. The eagle was made to run and allowed to fly only for recreation.

All this in the name of education. Nature was not to be trusted, for individuals should be symmetrically developed and similar for their own welfare as well as for the welfare of the community.

The animals that would not submit to such training, but persisted in developing the best gifts they had, were dishonored and humiliated in many ways. They were stigmatized as being narrow-minded specialists, and special difficulties were placed in their way when they attempted to ignore the theory of education recognized in the school.

No one was allowed to graduate from the school unless he could climb, swim, run, and fly at certain prescribed rates; so it happened that the time wasted by the duck in the attempt to run had so hindered him from swimming that his swimming muscles had atrophied, and so he was hardly able to swim at all; and in addition he had been scolded, punished, and ill-treated in many ways so as to make his life a burden. He left school humiliated, and the ornithorhynchus could beat him both running and swimming. Indeed, the latter was awarded a prize in two departments.

The eagle could make no headway in climbing to the top of a tree, and although he showed he could get there just the same, the performance was counted a demerit since it had not been done in the prescribed way.

An abnormal eel with large pectoral fins proved he could run, fly, climb trees, and swim a little. He was made valedictorian.<sup>1</sup>

Almost every teacher, especially those in high school and college, can recall instances where students have had to repeat the same subject several times. Some students have been driven from school because of their inability to pass a certain course after two or three attempts. Others have survived, academically

<sup>1</sup>As quoted by WILLIAM H. BURNHAM: *Success and Failure as Conditions of Mental Health, Mental Hygiene*, 3: 387-397, 1919.

speaking, but in doing so have suffered an ordeal that left its scar on their personality. In cases where students do well or reasonably well in all but one or two subjects and where these, for one reason or another, seem to be insurmountable obstacles, it is good educational procedure to substitute other subjects for the overly troublesome ones. In some instances, the difficulty of the student is overcome if he is given a change of teacher. Adjustment of one kind or another should be made so that one or two subjects should not destroy any student's whole educational career.

Adults are not required to be uniformly proficient in many departments. Adult life does not call for symmetrical development; much less does child life. Only in school do we work for it. In adulthood, we are most successful when we do the work in which we are most interested and when we capitalize on our greatest capacities. To be sure, adult conduct is not an infallible guide in indicating how children should be trained, for it is conceivable that education should aim at establishing different practices which may be better than the present ones. Still it is extremely doubtful that a pupil should spend on his weaker subjects more time than is average for any subject. To reiterate, more growth results from a unit of time spent in cultivating and perfecting one's greater talents than in attempting to develop one's weakest powers. The Greek ideal of all-round harmonious development is still too much with us.

This discussion can be illustrated by the college record of a person who has since reached a certain degree of distinction. As a student, he exhibited marked talent in composition, literature, and public speaking; he was also proficient in history and the other social sciences. In mathematics, physics, chemistry, and the other natural sciences, he was poorer than average. His marks thus showed a sharp division into two groups. In the literary and expressive arts, he was excellent; but in the quantitative fields of study, his abilities were below the average of college students. There is hardly any doubt that he profited by having taken the courses in mathematics and natural science, but his greatest natural assets lay in the other fields. Those were the ones in which his development was to be most significant.

He developed his natural talent for effective expression and broadened his knowledge in the social sciences. The history

of this individual, as a university president, reveals a serious deficiency because of a lack of that critical insight and realism characteristic of those who have a sharp quantitative sense. If a persistent and laborious study of mathematics, statistics, physics, chemistry, and other similar subjects had developed the power and habit of thinking quantitatively and had given him power to control his affairs with greater regard for the most important factors in the situation, then by all means he should have spent more time on the subjects in which he was poorest. It is doubtful, however, that special and additional training in those subjects would have changed the character of his mental processes to such an extent that it would have made him much more effective in adult life. There is little evidence to show that a person's particular intellectual weaknesses can be overcome by special training. Generally, the strong points are developed to cover the weak ones. Adjustment consists of choosing work that makes only minimum demands on the abilities in which one is weak. The person referred to here was unsuccessful as an administrator, but he does well as a writer and lecturer and, therefore, should cultivate the field wherein he is successful.

**Promotion and Enrichment.**—A common method of adjusting to individual differences is to give extra promotion to the brighter pupils. Such extra promotion is justified in a sense, because these pupils are capable of doing the work of one or two grades and even more above the grade that is normal for their chronological age. In fact, the wide range of mental ability in each grade would indicate that the brightest pupils are the most retarded. They are retarded, in effect, because their mental ability is ahead of the average for their grade, whereas the dull average child is actually accelerated in grade because his mental ability is below that average.

Yet although these arguments are true enough, there may be other aspects of the problem that lead to objections against too much extra promotion. Furthermore, there may be a better method of taking care of the brightest students. Other factors must be considered besides the capacity to learn. The physical adjustment and social adaptations of the child are also important. Several extra promotions that bring the child into a group whose chronological age level is several years in advance of his own may lead to an unfortunate physical and social maladjustment. A



child with mental maturity in advance of his years will be grouped with children who are larger physically and more advanced socially than he. The bright youngster may be able to compete with the older pupils in the recitations and in the examinations but may be a misfit in the sports, games, parties, and general activities of his fellow pupils.

It is questionable if a pupil should be accelerated more than two full grades or two years, even if he is capable of doing the classwork. A student should not finish high school over two years younger than the average of the class. There can be no definite rule, but it is a good principle not to group a child so that he is several years younger or older than the other members of his class. When in school, a pupil is living an important part of his life; he is more than a learner of facts and should associate with pupils with whom he can live most happily as well as learn most effectively.

**Enrichment.**—By enrichment is ordinarily meant the inclusion of additional materials and activities at a given grade level in order to permit those who can do more than the average amount of work to achieve up to their capacity. Thus, for example, when a geography class is studying about the state of New York, the brighter pupils read books on the subject for which others will not find time, prepare illustrative materials, interview people who have been to New York, and in general engage in activities that will give them a more comprehensive understanding of the subject. Opportunities to learn about a subject must be adapted to the individuals of the class according to their individual abilities.

Enrichment may not only manifest itself as the extension of study and activity in subject-matter fields but may also include extra activities such as dramatics, music, bird lore, gardening, and other projects. Enrichment of this kind consists of enlarging the number of activities and subjects as against more extended and intensive work on fewer subjects.

The school need not always concern itself with the problem of enrichment for all children. Some parents introduce special training in music, dancing, dramatics, or art early in the lives of their children and continue it as long as their children are in school. Their children attend special classes after school or on Saturdays. If the pupils are spending some of their out-of-

school hours in such activities, the teacher should not load them with special work in order to achieve enrichment. They are already experiencing desirable forms of enrichment, and the teacher may concern herself primarily with enrichment of the subjects and activities usually regarded as the more essential elements in the curriculum.

**The Dalton Plan.**—One of the more widely known programs for adjusting to individual differences is the Dalton plan. By this plan, the rooms of a school are so arranged that a separate room or laboratory is set aside for each subject and is specially equipped. For example, the history room will have books, maps, and other materials for the study of history. The teacher of history is present in this room not to instruct formally but to help the students.

Each assignment covers work to be done in a month's time. Each monthly allotment is called a contract. The pupil is given the opportunity to exercise his own initiative as to how soon he is going to complete his contracts in the various subjects during the course of the month. He is tested periodically so that he may know how well he is achieving.

A modification of this plan which takes into fuller account the differences in the capacities of children is a system of contracts by which the pupils according to capacity and willingness agree to do different amounts of work and receive a mark appropriate to the amount and the quality of work accomplished.

**Conclusion.**—Great differences in the capacities and characteristics of pupils are a proved fact. There are many ways of adapting the schools to those differences, and several methods have been mentioned and discussed. If the teachers, principals, and superintendents know the facts about individual differences and are willing to try out methods and actually experiment with adapting the schools to individual differences, great progress will be made.

#### SUMMARY

In a general way, measured mental ability indicates the probable success of students in school. The general aptitude tests are best for predicting success in the general academic subjects and are less valuable for predicting success in technical or special subjects, such as industrial arts, drawing, and physical education.

Mental level and success in school should be considered in terms of the level of school because it is a little harder to succeed in high school than in the grade school, harder in college than in high school, and still harder in the professional and graduate schools.

Because there are a large variety of subjects, departments, and schools, adjustments can be made for abilities other than general mental ones. Students have mechanical, musical, and special social abilities which if measured could be used to guide them into the type of work where they would be most successful. Because of the great variation in both opportunities and abilities, training can be fitted to the person's aptitudes.

Schools have, from almost the beginning, classified children according to their chronological age, and it is possible to improve that classification by taking into account their mental and social development as well.

Ability grouping has been used in a large number of schools and seems to have advantages for instructional purposes and because of the effects on personality.

Another way of adjusting the schools to the abilities of the pupils is to have individual instruction, use the contract plan, and to enrich the work for those of greater capacity.

Individual learners differ also, being better in some departments or courses than in others. It is doubtful, however, that more time should be spent on one's lesser than on one's best abilities.

### Problems and Exercises

1. To about what extent will those who are high in ability have a greater chance of success in school than those with low ability?
2. Why do some students who are comparatively good in the lower grades turn out to be only average or poor in college?
3. What courses do you advocate for students of high I.Q., and which courses should be avoided by students of low I.Q.?
4. What is meant by special abilities, and what tests should we have in order to measure them?
5. Describe what would be an ideal system of guidance if we had adequate tests and a variety of schools.
6. Discuss whether or not you favor classification of children according to capacity to learn.

7. Give your reaction to placing a bright non-achiever in a class given largely to drills and reviews.

8. What dangers do you see in a system where all the instruction is individualized?

9. In one school, the child spends all his extra time on the subject in which he is poor, although in a few subjects he is very good. Comment.

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## CHAPTER X

### HEREDITY, ENVIRONMENT, AND HUMAN DEVELOPMENT

**Directions for Study.**—The purpose of this chapter is to give the reader some of the most important facts on the subject pertaining to how human beings obtain their capacities, abilities, and characteristics. It is hoped that the student will obtain a fairly adequate knowledge of a topic that is current in the minds of many people. Furthermore, it is hoped that he will develop a philosophy about the education and improvement of the human race based as far as possible on truth and fact. Observe that the question is not one of heredity versus environment or nature versus nurture, but rather one of the interrelationship of those two general factors.

Be able to explain how the attack of teachers, ministers, or doctors and others on their problems will be influenced by their point of view on the problem of heredity and environment.

Form some conclusion as to the human qualities and characteristics that are determined more by nature's forces than by nurture's, and vice versa.

Be able to explain how the genes, or determiners, control hereditary characteristics.

Four principles of inheritance are given that tend to explain the characteristics of the children in any given family.

When studying the topic on family lineages and relationships, learn the important facts from Galton studies. Also learn the facts about the Tuttle-Edwards and the Kallikak lineages.

Examine carefully the degree of similarity of various characteristics and the degree of blood relationship.

Be able to give an explanation for the relationship between occupational status of parents and the abilities of their children.

Evidence is given indicating that the human race can be improved by genetic means. Note that in the case of rats there was great improvement by the eighth generation.

Study carefully the evidence showing the influence of foster homes on the behavior, school progress, and general mental ability of foster children.

The most fascinating evidence is based on a study made of identical twins reared apart. It shows that different environments in some instances definitely do effect the mental ability, health, and emotional adjustment of human beings.

Observe the relationship between the age of pupils in a given grade and their abilities.

Concrete objective evidence is given showing that measured mental ability declines where children are kept out of school year after year. Examine the data carefully.

What is meant by "The people make the school; the schools do not make the people"?

What is your point of view or philosophy on the matters discussed in this chapter?

We often ask ourselves whether the characteristics of a child—his being good or bad, bright or dull, healthy or sick, happy or unhappy—depend principally on his heredity or on his environment. Likewise, in judging the adult, some attribute his success to his opportunities, whereas others hold that his capacities were innate.

Some observers think that it is futile for educators to concern themselves with this problem of the relative influence of heredity and environment. They say that teachers can not do anything about the basic heredity but must accept the children as they are and teach them as effectively as possible.

Obviously, such a viewpoint is superficial, and it discourages our attempting to be intelligent about an important problem. If people understood the laws of heredity and acted upon their knowledge, progress could be made in improving the race by genetic control. Furthermore, if the importance of environment were accurately understood, more efficient educational institutions could be maintained.

To the teacher, knowledge of the relative effect of the forces of heredity and environment on human development and their interrelationship is of signal importance. Teachers are the main environmental factor in the children's school life. A teacher is valuable according to her ability to develop the potentialities of her pupils and to make desirable changes in them. She must

understand the possibilities and limitations of the human material with which she works. Her philosophy and methods of teaching are greatly affected by her concepts of the possibilities of training and education.

The teacher who believes that children's development depends on her efforts alone will misdirect much of her energy. There are teachers who believe that "every child is a diamond in the rough which needs only polishing in order to reflect the light of intelligence." According to this notion, every child has great possibilities which will be realized if the teacher will only work hard enough to develop them.

Other instructors feel that a child will develop in the directions determined by his heredity and that the guidance and training of children by parents and teachers matter very little. A teacher with such beliefs will miss many opportunities to develop the latent capacities of her pupils.

The extreme view on the potency of training was dramatically stated by the psychologist Watson, who startled the world by saying, in substance, that if he were given a group of healthy infants he could train or condition them to become lawyers, beggars, doctors, or thieves and that he would use definite psychological methods to make each infant into an adult of a predetermined pattern. Such a plan of training assumes that what a child can be made into depends entirely on the training he has received and denies almost entirely the variation in quality of the human organism.

Other students of this problem are reasonably sure that some infants are born with a quality of nervous system that will prevent them from ever acquiring the knowledge and abilities necessary for certain professions. Possibly a few educators and psychologists hold that psychologically sound training is all that is needed to mold the human organism into any pattern, but such an extreme point of view is hardly based on sound evidence. It is futile, however, to discuss the influences of environment and heredity without making clear the particular nature of these influences.

Probably heredity is largely responsible for some human characteristics; environment, for others. The color of the eyes, width of the head, fingerprint patterns, age at puberty, and stature are probably determined chiefly by genetic factors. On

the other hand, such psychological matters as temperament, disposition, ideals, and attitudes are probably more affected by environmental influences. This probably is especially true of ideals and attitudes. Specifically, the health of a normal child depends to a considerable extent on the good sense that the mother exercises in caring for him. For example, raising children without an adequate diet causes many of them to develop rickets, but children who are well nourished, given cod-liver oil in the winter, and exposed to sunshine in the summer rarely develop rickets. Health and qualities of personality reflect the care and training that one has received, whereas some traits and characteristics are more fixed at birth. Scientific care during the prenatal period and during infancy prevents a large proportion of deaths; but after a person has reached adulthood, the factors that determine whether or not he will live a long life are largely hereditary in nature. Thus the relative influence of environmental and hereditary factors may vary at different ages and influence various characters differently.

**The Mechanics of Inheritance.**—A human being has its beginning in the union of the male germ cell, the sperm, with the female germ, the ovum. They unite and then divide. Cell division continues, and the result is the growth and development of the embryo. The united germ cells of the parents also separate and are preserved in the embryo. Thus, the child carries the germ cells of its parent, so that the stream of germ cells is continuous from generation to generation.

The germ cells contain chromosomes, 24 in the germ cell of each parent.

The chromosomes, in turn, are made up of genes, or determiners, and each chromosome consists of about 40 to over 100 of these determiners. At the time of conception, the genes, or determiners, in the chromosomes of the sperm pair with the genes of the ovum and determine the potential characteristics and qualities of the offspring. The result of the union of the genes we call *heredity*. Figure 9 illustrates the process graphically(1).

If the father's genes for tallness unite with the mother's genes for tallness, then the offspring will inherit tallness. Similarly, if the male genes for good mentality unite with the female genes for mentality, then the child will inherit brightness. Similarly for nearly all traits. If, for example, the father and mother carry



genes for weak lungs and those genes pair up, then the offspring will have weak lungs and will have a predisposition to tuberculosis. If the environment of the offspring is conducive to tuberculosis and causes him to be exposed to infection, he probably will become infected. Disease is not inherited, but the weaknesses are; therefore, some people have a natural predisposition

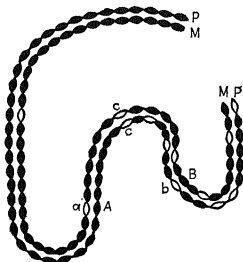


FIG. 9.—Diagram to illustrate the arrangement and action of the genes in the genetic system. The genes are represented by the spindle-shaped bodies, arranged in consecutive order, in long paired strings, the chromosomes. One string (*P*) of the pair comes from the father, the other (*M*) from the mother. Thus the genes themselves are in pairs, one member of each pair from the father, one from the mother. The genes shown in white are to be conceived as defective genes. (From H. S. Jennings, *Biological Basis of Human Nature* by permission of W. W. Norton & Company, Inc., 1930.)

to infection, whereas others are born so strong that they resist nearly all diseases.

This summary description is a very simple, probably an oversimplified, explanation of the inheritance of traits and abilities as determined by the uniting of the genes of the chromosomes in the sperm and ovum. Still, it is essentially the process of inheritance. Discussions of certain other important factors, such as Mendelianism, dominance, recessiveness, sex-linked and unit characters, and mutations, can be found in books on genetics or biology. The mechanics of human inheritance are not definitely known to the extent that we can determine how specific

traits are inherited, but for our purposes it is sufficient to indicate the general principle.

**Heterozygous and Homozygous.**—Individuals are carriers of determiners which are heterozygous for various traits, because genes or determiners vary in quality; in other words, they are not homozygous. Thus, a very brilliant man or woman may carry some genes for the quality of intelligence, ranging all the way from dullness to brilliance. If the genes for brightness combined, the offspring would be bright; but the genes for dullness could unite, and the offspring would be dull. Similarly for all degrees of intelligence between these extremes. Some adults carry more genes for producing an organism that learns readily from its environment than do others, and some carry determiners for an organism that adjusts poorly to its environment. The majority of people carry genes that produce an average or nearly average organism. It is doubtful that even a single individual, to say nothing of husband and wife, is homozygous for any given quality. The germ cells carried by any individual have such a varied background of ancestors that it is doubtful that the determiners are homozygous. If two parents were homozygous for high mental capacity, for instance, then all their offspring would inherit high mental capacity. If the germ cells were homozygous, no determiners would be present to cause low mental ability. On the other hand, if the parents were homozygous for feeble-mindedness, then all their offspring would be feeble-minded.

In the selective breeding of horses and cattle, an attempt is made to breed the better animals because they have the most genes, or determiners, for producing the best offspring. For example, in breeding race horses, the best runners are used for breeding purposes; and among those, in turn, the best ones are soon discovered when the abilities of their colts are tested. The same principle is applied to dairy cattle; and in their case, the test consists in the ability of the offspring to produce butter fat. When the best animals produce offspring and the poorer ones do not, the result from generation to generation is that the animals possess more of the better genes or tend to become homozygous for the highest qualities.

**Improving Human Beings Genetically.**—One can hardly touch on the process of inheritance without raising the question of improving the quality of the people genetically, that is, through

selective mating. Would the average quality of our people be raised if the more gifted people had more offspring and the dull and feeble-minded had very few, if any? Most of our inadequates are not born of parents who are idiots or imbeciles but of parents at the moron or borderline level. Even though parents of low intelligence and character did not have offspring, however, incompetents would still be born to capable parents because the germ cells of some of them contain defective genes. Nevertheless, there would be fewer defectives, and they would become progressively fewer from generation to generation. People would carry fewer and fewer determiners for deficiency.

Even though the average quality of the human organism were raised by selective mating, our educational, social, and economic problems would not automatically be solved. Variation in abilities would still exist; and although the variation would not be so great as it now is, still we should have the relatively stronger and the relatively weaker. It should be the function of education, with the ideals, attitudes, and motives that it inculcates, to determine whether or not the strong would still continue to exploit the weak. It is conceivable that we might have as much injustice and inequality of opportunity as we now have. We can improve people genetically, but only the environmental forces that develop customs and points of view can cause people to work for the general welfare rather than selfishly for themselves. True, the people improved genetically would be more teachable, but that means that they might just as easily be taught to have an antisocial point of view as a social one. Consequently, in order to improve our people it is necessary to do it through social education as well as through genetics.

A professor of educational psychology expressed a striking point of view as to the importance of heredity and environment when he stated to the students in his college class that if the most capable of his class mated with those of similar capacity and had large families, they would contribute more to society than by being teachers of children. The point is probably well taken, although we should not necessarily take the position that hereditary forces are more important than environmental forces, or vice versa. We need both a good biological and a good social heritage. It is not so much a question of which is more important but how the best values in each can be utilized. Further-

more, it is well to recognize how much we can accomplish genetically, how much educationally, and how much by means of other environmental forces. It is not a matter of one against the other but the particular function of each and their most effective balance and working together.

**Congenital Influences.**—The congenital period of life is the embryonic period, or the period of pregnancy, or gestation. It is the period between the union of the male and female germ cells and the time of birth. For human beings, it is about nine months long.

Questions are often raised about the various factors that may affect the embryo and thus influence the character of the child. The effect of faulty nutrition on the growing embryo, the effect of pressures and strictures on its development, and the chemical balance of the mother are still matters of speculation. Little is known about them, although it is certain that some children are injured at birth in a manner that affects them physically and mentally during all their lives. Venereal diseases may also be contracted congenitally, or during the embryonic period.

Little need be said about the transmission to the embryo of the experiences and thoughts of the mother during pregnancy. The superstition that pregnant mothers frightened by dogs or otherwise frightened or distressed will consequently give birth to dog-faced children or other monstrosities has no validity. Illness and great emotional stress may possibly affect the embryo, but the wishes and ideals that a mother has for her child are not transferred to it. A mother may listen to great music and hope that her child will thereby be a great musician, or she may spend hours viewing masterpieces of painting with the wish that her offspring will become a distinguished artist. She may daydream about the future of her child, but all her hopes and visions have absolutely no effect on the embryo, no congenital influences.

Children do not inherit the acquired abilities of their parents. As an adult gets older, he may acquire different skills, increase his efficiency, and add to his store of knowledge, but such improvement is not transmitted to his offspring. The germ cells are independent of such influences. If an enlarged scope of experiences were inherited in the children, the younger children in a family should surpass the older, or the last born should be more capable than the first born. Such is not the case, for there

is no relationship between order of birth and the intelligence of the offspring.

### SOME PRINCIPLES OF INHERITANCE

**Like Begets Like.**—The general principle of inheritance is that like tends to beget like. This principle will be interpreted here to mean that bright parents have bright children; average parents, average children; and dull parents, dull children. Similarly, in the case of physical size, there is a tendency for the mature size of the offspring to be similar to that of their parents. Thus, on the average, the children tend to be like the parents, but there are many exceptions to the rule. This fact leads us to the second principle, the principle of variation.

**Variation.**—Children are not exact replicas of their parents, nor do they develop to be precise reproductions at any given age of what their parents were at that age. The reason lies in the characteristics of the germ cells of the parents. Germ cells contain many determiners which unite in different combinations to form offspring differing among themselves.

For purposes of illustration, let us assume that two human parents could have a very large number of children. The average quality of the offspring would be determined by the quality of the parents' germ cells. For some parents, the average would be high; for most, it would be average; and for some, it would be low. Most of the children would be at the average of their parents or near it, but they would vary from it according to the principles of chance or probability. As the distance above and below the parental average increased, the number of children with those characteristics would decrease.

This principle of variation explains why children in the same family differ in intellect, size, and temperament. They are a product of different combinations of the determiners in the parent germ cells. But though they differ, they tend to be more alike than do unrelated children. Brothers and sisters (siblings) have their similarities, although they vary from their family average.

**Regression.**—The tendency for children of very bright parents to be less bright than their parents and a comparable tendency for the children of very inferior parents to be less inferior is called *regression*. For any trait, there is a tendency for the

children to regress toward the average. Not all the offspring will regress; but, on the whole, they will move toward the average rather than farther below or above it, as the case may be.

It is often observed that the children of a very gifted father or mother are not so gifted as the parent. A son of a great athlete seldom becomes as great as his father, or the son of a great scientist as great as his father. There are several reasons for the regression. In the first place, the father, for the traits that he possesses, represents the product of the most fortunate combination of the determiners in the germ cells of his parents. Therefore, the germ cells that he carries are, on the average, inferior to the particular combination from which he developed.

Secondly, it is likely that he will not mate with a woman so distinguished as he and that his mate is almost certain not to carry germ cells so good as those which combined at the time of his conception. Though the offspring will tend to be decidedly above the average, it is unlikely that they will be as great as their father. This is regression.

Similarly, the germ cells of two idiots are better than the combination from which they sprang; and therefore their offspring will be better than they, possibly averaging imbecile or low moron level. There may even be an occasional child that is average or higher, and there will be offspring as deficient as their idiot parents; but most of them, though deficient, will be higher than their father and mother.

These three general principles—like tends to beget like, variation, and regression—are useful in trying to understand the characteristics and qualities of people. In general, the offspring tend to be as bright, as tall, as healthy, etc., as their parents, but they vary above and below the average ability of the stock from which they spring. Furthermore, there is a tendency for the offspring to be lower in the characteristics in which the parents are high or higher in those traits in which the parents are low. They regress, or move toward the average.

**Ancestry and Inheritance.**—The child's heredity, however, is not determined solely by his immediate parents, for he inherits not only from his father and mother but from his grandparents, his great grandparents, etc. In other words, he inherits from his ancestors; but, of course, he inherits most from his immediate parents; and, as the parentage becomes more remote, the heredi-

tary influences decrease. Proportionally, the child inherits one-half from the father and mother; one-fourth from the grandparents; one-eighth from the great grandparents; one-sixteenth from the great, great grandparents; etc. It is partly due to the heredity from these less immediate ancestors that very superior parents generally have less superior children, and very inferior parents have children better than themselves. The hereditary determinations, however, from remote ancestry is least, and most of a person's inheritance comes from his immediate ancestry.

#### FAMILY LINEAGES AND RELATIONSHIPS

One approach to the problem of determining whether or not capacities and characteristics are inherited or acquired from environmental opportunities is through studies of family lineage. When most of the members of some families are considerably above average and many distinguished men and women are included in the family lineage, it has been concluded that high capacity is inherited. Similarly, if the members of some lines are definitely below average and many of them are feeble-minded, immoral, and socially inadequate, it has been generally concluded that deficiencies are also inherited. In order to become acquainted with both the method employed and the data obtained, it is well to examine briefly some of the more important of these studies.

**Distinction and Family Relationships.**—Probably the most often quoted data are those of Sir Francis Galton, the English scientist of the nineteenth century who studied the frequency of eminence among the relatives of persons who were outstanding(2). He chose a group of 977 eminent men, each of whom was judged to be the most distinguished person of 4,000. Although most of them have no historical importance, the group represents a high selection of ability. These 977 men had 535 relatives—fathers, sons, brothers, grandfathers, grandsons, uncles, nephews—who were equally eminent. For comparison with the 977 eminent men, a group of 977 was selected from the population at large with no regard for their degree of eminence. Among their relatives were found only four eminent people. If the selection was representative, the ratio of eminence among the relatives of eminent men to the eminence among relatives of a sample of the population in general is 535 to 4, or about 134 to 1.

Another study of a similar nature generally advanced to prove that capacity is inherited is that of the Edwards family(3), although more strictly it should be referred to as the Elizabeth Tuttle strain. Richard Edwards, the grandfather of Jonathan Edwards, in 1667 married Elizabeth Tuttle, a beautiful and brilliant woman. She was divorced by Richard Edwards for adultery and other immoral behavior. She was not, however, the only black sheep in her family, for her sister killed her own child, and a brother murdered a sister. Elizabeth Tuttle herself, to judge by her character and general career, had she lived today would no doubt have been a notorious play girl, many-time divorcee, and tabloid heroine. She and Richard Edwards were the parents of one son and four daughters. After divorcing her, Edwards married Mary Talcott, an ordinary woman, a good, faithful wife but with no special talents. To the union of Richard Edwards and Mary Talcott five sons and one daughter were born. From this triangle of the colonial period, we have two strains, the Elizabeth Tuttle strain and the Mary Talcott strain, with Richard Edwards the male factor, constant in both.

Jonathan Edwards was a grandson of Elizabeth Tuttle; and, as stated above, the family tree has been erroneously referred to as Edwards' rather than Elizabeth Tuttle's. She doubtless carried unusually good germ cells, because on her side of the Richard Edwards lineage many eminent persons may be found. Strangely and incongruously, many of Elizabeth Tuttle's descendants were eminent clergymen, college presidents, and college professors. Included in the lineage were also authors, judges, congressmen, lawyers, and military officers, including Aaron Burr, Robert T. Paine, Grover Cleveland, and Ulysses S. Grant. Apparently, the union of her germ cells with those of Richard Edwards formed a combination resulting in a stream of germ cells that created men and women of fine capacity. Through environment and training, they became men of the pulpit and other professions rather than those with the habits and practices of Elizabeth Tuttle, one of the fountainheads of their lineage. On the other hand, little ability and no greatness appeared in the descendants of Mary Talcott.

Studies show that in the United States, most eminent men are born in New England; and that in France, Paris is most productive of distinguished men. Studies also indicate that the



fathers of distinguished men tend more often to be professional men, such as clergymen, lawyers, and doctors, rather than laborers and farmers; that great scientific men have comparatively many relatives who are also outstanding men in science; and that eminence exists in some royal families more than in others. Practically all such researches and others like them indicate that capacity is inherited. A review of these studies cannot be given but can only be mentioned in passing.

The evidence is rather clear that those who achieve the higher degrees of success tend to have relatives of achievement much more often than do those whose achievements are only ordinary. Distinction and eminence, then, do tend to run in families though much more frequently in some families than in others.

**Environment and Success.**—The fact that eminence characterizes some families much more than others is not indisputable proof, however, that great abilities result from inherited capacity rather than from superior environmental advantages. A child born of superior parents, who in turn had superior relatives, is apt to inherit not only a superior capacity but also a superior environment. He will receive better medical care before and after he is born; his diet will be more adequate; he will hear better speech; and he is more apt to grow up with a feeling of confidence because of his socioeconomic status. Because his parents and his relatives have a high regard for education, he will be given the finest educational and cultural advantages. When he is ready for a position, he will have the help of his influential relatives. It is conceivable and well within the realm of probability that with these decided advantages he may in time hold, for example, an important judgeship, whereas if he did not have them, he might be a practicing lawyer, more or less successful, or occupy an even less distinguished position. Similarly, these advantages help one to obtain other important positions and to be more successful in the profession that one follows, be it medicine, law, the church, engineering, or teaching. Moreover, it is true also that because of selective mating, the environment, in a sense, indirectly influences heredity. When a person born into a favorable status seeks a mate, he will most likely choose a cultivated person with a similar background. Consequently, their offspring, in turn, will inherit

well, both biologically and culturally. The forces of biological inheritance and social inheritance work hand in hand and should not be considered independently.

Nevertheless, it is very doubtful that even excellent training will develop an average or below average person sufficiently to qualify him for an important position or for work that requires a high order of ability. For example, no amount of training can make a scientist out of a boy with an I.Q. of 90, who when trying his utmost is only average in his schoolwork. Furthermore, though experience and training obviously are essential for the complete development of one's powers, the basic capacity for scientific work is probably inherited. The history of some outstanding scientists indicates that they rose out of the most unfavorable environments because of the sheer drive of their native powers. We say of such people that talent is in them and cannot be kept from coming out.

Still, we must not overlook the fact that outside the extreme represented by genius, eminence, or distinction, we have many men and women who, though excellent in their professions, cannot be classified as outstanding. There are, for example, many psychologists who do excellent and useful work but are far from the category of distinction that includes William James, James McKeen Cattell, and Edward Lee Thorndike. Doubtless a few capable people occupying important positions in small communities, if properly and thoroughly trained, might have become as important as many men now in the professions and in scientific research, for a considerable number are doing commendable scientific work or are successful in the professions because of their training; and others might have had the same status if they had received the necessary education. The point is that, except for those of high inborn talent, of a group of capable people who are potentially equal, those who are given a superior education attain a higher status than those with an inferior one. This point of view is somewhat speculative, but critical observation of people and their achievements suggests that it has considerable validity.

**Deficiency and Family Relationships.**—Like eminence and distinction, mental deficiency and social inadequacy tend to run in families. Examination of some family lineages has indicated that feeble-mindedness, immorality, alcoholism, and

poverty characterize the members for generation after generation.

The study most often referred to in this connection is one of the fictitiously named Kallikak lineages(4). The story of Martin Kallikak begins in the period of the American Revolution, when Kallikak was a soldier. This study, like the study of the Edwards families, begins with the eternal triangle. According to the study, Martin Kallikak is purported to be the ancestor of two lines of descendants. One is supposed to be through an affair with a feeble-minded inn girl; the other, through his legal wife, a home-town girl of normal intelligence, whom he married after he returned from the war. Then, just as Richard Edwards was the progenitor of two lineages, one with Elizabeth Tuttle and one with Mary Talcott, so was Martin Kallikak—one with the inn girl and one with his wife.

In the line of descendants that had its beginning with Martin Kallikak and his wife, normality has prevailed, there being only an occasional mentally defective, alcoholic, or sexually immoral person in this line. In the other strain, a pedigree that had its beginning with Martin Kallikak and the inn girl, were discovered many feeble-minded, alcoholics, prostitutes, and criminals. There were some normal progeny, and unfortunately the status of a large number is unknown. In general, however, normality characterizes the one pedigree, whereas deficiency and social inadequacy characterize the other.

Because the Kallikak lineages are described so frequently to illustrate the inheritance of undesirable characteristics, it is well to examine critically the framework of this study. In the first place, we cannot be certain that the inn girl was feeble-minded. She may have been mentally dull or deficient, but we have no way of really determining the mentality of a person living some 160 years ago. Secondly, we cannot be certain that Martin Kallikak was the father of her illegitimate child. If, indeed, she was feeble-minded or a girl of easy morals and working in an inn frequented by soldiers, it is possible that another man might have been the father. One might, moreover, question the method of determining the intellectual and moral status of the descendants. Not only was the status of many of them unknown, but very likely the description of those reported as feeble-minded was based on inadequate records. There are so many uncertainties surrounding several important points on which the

validity of the investigation hinges that one is hardly justified in attaching as much significance to the study as is usually done. / Another well-known family of social defectives began with Max Jukes. Many of his descendants were thieves, paupers, prostitutes, and otherwise socially deficient. It has been estimated that this line of incompetents and others like it have cost the government millions of dollars. Consequently, many workers in prisons, insane asylums, and institutions for feeble-minded are convinced that deficiency runs in families and is inherited. In spite of the inadequacy of the studies that have been made, the evidence seems to indicate that deficiency tends to run in families, though the environment may have played an important part in making them public charges.

Again, it must be pointed out that the Kallikaks and Jukes and others of similar status not only inherit deficiency but are born into an environment that accentuates and perpetuates it. An infant Kallikak or Jukes is born into an atmosphere of poverty, vice, and disease. At birth, he is given a poor reception; his years of dependency are spent in squalor; the language that he hears is rudimentary and obscene; and during his lifetime, he is surrounded by circumstances that fetter him with the traditions and habits of his parents. It would be interesting to know what differences would have resulted if Elizabeth Tuttle and Richard Edwards' offspring had been reared by the Kallikaks or Jukeses and if the Kallikaks and the Jukeses had been reared by the Edwardses. Doubtless, all of them would have been influenced, the Kallikaks and the Jukeses for the better and the Edwardses for the worse.

Such an exchange would have varied the possibilities for mating and would inevitably have changed the development of the line. The Kallikaks would have been in a position to choose better mates; the Edwardses in a Kallikak environment would doubtless have chosen poorer ones. Genetically, both groups would have regressed or moved toward the average, the Edwardses down and the Kallikaks up.

No one can defend with logic or facts the opinion that a favorable environment will make Kallikaks and Jukeses into intelligent leaders. Evidence against the point of view that environment is the alchemy that will transmute lead into gold exists in the cases where distinguished families have children who are mentally deficient. These children are given every advantage, are

often taught by a special tutor and controlled by a governess. Still, "Kallikaks" born into a most favorable environment will always be feeble-minded. As a consequence of their training, they probably will be courteous and well-mannered; they may develop wholesome interests which help them adjust well during their leisure time. Also, they will be protected from acquiring many of the vices to which the feeble-minded seem more susceptible than normal children. They will be very different from what they would have been had they been raised in a Kallikak environment, but they will never manifest those abilities which characterize an educated and able man or woman.

### BLOOD RELATIONSHIP AND ABILITIES

In the same generation, the most closely related individuals are identical twins—born from a division of the same cell. Next in degree of relationship are fraternal twins, or those born from the union of two separate cells; then children of the same family, or brothers and sisters; then cousins; and so forth. The correlation of abilities between parents and children is higher than between grandparents and grandchildren or between uncles and aunts and their nephews and nieces.

The relation of abilities is not known for all degrees of blood relationship but is known for enough of them to indicate that abilities correlate to an extent corresponding to the nearness of the kinship. Correlations have been calculated to determine the relation in tallness, weight, mental-test ability, and achievement in school subjects as well as in other characteristics and abilities. The results vary a little from investigator to investigator, but the following correlations for the various degrees of blood relationship are reasonably accurate in indicating the general trend.

| Relationship                            | Correlation |
|-----------------------------------------|-------------|
| ✓ Identical twins .....                 | .80-.90 ✓   |
| Fraternal, or non-identical, twins..... | .65-.70     |
| Brothers and sisters (siblings) ...     | .45-.50     |
| Cousins.....                            | .20-.35     |
| Unrelated children. ....                | .00         |
| Parent-child.....                       | .40-.45     |
| Grandparent-grandchild ..               | .10-.20     |

Of course, these correlations are not necessarily indisputable proof that various physical characteristics and the capacities for

various abilities are inherited according to the degree of blood relationship. For, in fact, it is likewise true that the closer the degree of blood relationship the more nearly alike is the environment. This fact has been mentioned several times before.

In the case of twins, prenatal environment is more similar than in the case of non-twins. Brothers and sisters experience a more similar environment than do cousins; nevertheless, the fact that sisters and brothers differ is just as valid an argument that traits and capacities are inherited as the fact that they correspond to a degree represented by a correlation of .45 to .50.

The knowledge of right or wrong of parents and children correlates about .50, which is essentially the same as the correlation for nearly all other traits and capacities. Although the capacity for ethical knowledge is perhaps inherited, still it would seem that a knowledge of ethical conduct and related ideals and attitudes is to a large extent the product of home teaching and home environment. That the parent-child correlation for a quality probably acquired is as high as the correlations for other qualities generally considered inherited raises a question as to the validity of concluding that high correlations indicate the inheritance of those qualities.

This conclusion, which has been held by some observers, is a little extreme, no doubt, but represents a belief that contains truth. It serves, at any rate, to point out the fact that environment works with heredity in making related people more alike. Nevertheless, it is true that no one can observe the appearance of a pair of identical twins—the similarity of size, features, eye color, twirl and shade of hair, fingerprint, achievement in school, and disposition—without recognizing the importance of hereditary factors. On the other hand, the variations in the characteristics of siblings is not inconsistent with what we know about the principles of inheritance.

#### OCCUPATIONAL STATUS OF FATHERS AND MENTAL ABILITIES OF THEIR CHILDREN

A further point of interest is the relation between the vocational level of the parents and the intelligence of their children. The occupational status of parents is generally distributed over a range, at one end of which are the unskilled and at the other the professional workers. The categories often used are the

unskilled, the semiskilled, the skilled, the business-clerical, and the professional. Some representative occupations in an order corresponding to the classifications given are: hobo-transient, unskilled laborer, teamster, butcher, carpenter, policeman, auto mechanic, railroad clerk, bookkeeper, accountant, school-teacher, librarian, doctor, engineer, creative writer, and scientist. These occupations are considered representative of different positions in the occupational scale according to the amount of education, mental ability, or abstract intelligence required by the different occupations. The classification permits of exceptions, as some persons engaged in less skilled occupations possess more abstract intelligence than some in the more skilled and even professional occupations, but it is substantially correct.

We know that the I.Q.'s of the fathers correspond in general to their occupational status, so we should expect that the intelligence of the children would correspond in a general way to the occupations of the fathers. Thus, on the average, the children of professional parents have the highest I.Q.'s, and those of unskilled workers the lowest. That is, in fact, the trend. The correlation between occupational status of parents and I.Q. of the children is about .40. The relationship is very general, and again the question may be raised as to whether or not the superiority of children of professional parents is due to the genes of their parents or to the difference in the cultural and educational environment into which they are born. A child of professional parents obviously is exposed to more advantages than a child born into the home of an unskilled worker or parents on relief. Again we are in a situation where the relative effects of environment and heredity cannot be distinguished; and consequently, the differences in the qualities of the children cannot be definitely attributed to either. There is some likelihood that hereditary qualities accompany vocational status to some degree.

Eminent men have come from homes where the parents were of professional and business status more often than one would expect from the numerical proportion of these groups to the total population. In contrast to this fact, the laboring classes and the agricultural groups, which constitute such a large proportion of the population, produce only a relatively small percentage of the more distinguished and prominent persons.

Table VI indicates that the professional and semiprofessional groups, which constitute smaller proportions of the population, produce about three-fourths of eminent men and gifted children(5).

TABLE VI.—COMPARISON ON TAUSSIG SCALE OF THE OCCUPATION OF THE FATHERS OF PHILOSOPHERS, POETS, AND SCIENTISTS (ALL COMBINED) WITH THE FATHERS OF Terman's GIFTED CHILDREN\*

| Taussig classification | Fathers of philosophers, poets, and scientists (all combined) |            | Fathers of Terman's gifted children |            |
|------------------------|---------------------------------------------------------------|------------|-------------------------------------|------------|
|                        | Number                                                        | Percentage | Number                              | Percentage |
| Professional.....      | 65                                                            | 46.1       | 176                                 | 31.4       |
| Semiprofessional.....  | 35                                                            | 24.8       | 280                                 | 50.0       |
| Skilled .....          | 35                                                            | 24.8       | 66                                  | 11.8       |
| Semiskilled .....      | 6                                                             | 4.3        | 37                                  | 6.6        |
| Common labor.....      | ...                                                           | .....      | 1                                   | 0.13       |
| Total .....            | 141                                                           | 100.0      | 560                                 | 99.93      |
| Unclassifiable.....    | 30                                                            |            |                                     |            |
| No record.....         | 43                                                            |            |                                     |            |
| Grand Total .....      | 214                                                           |            | 560                                 |            |

\* PATERSON, DONALD G., and EDMUND G. WILLIAMSON, Raymond Pearl on the Doctrine of "Like Produces Like," *American Naturalist*, 63: 272, 1929.

### SELECTIVE MATING

In order to examine the effect of selective breeding on attempts at genetic control, it is necessary to investigate the work done with animals. The results of the tremendous amount of controlled breeding done with poultry, horses, hogs, cattle, etc., demonstrate conclusively how qualities may be improved materially through selective mating.

About the only evidence that we have pertaining to human beings is that given on family lineages. Controlled mating is incidental to the social and economic forces that caused persons of similar caliber to mate as in the Edwards and Kallikak families.

Of great concern to those engaged in education is the improvement of the intellectual caliber of the race through the genetic processes. No controlled experiments involving human beings



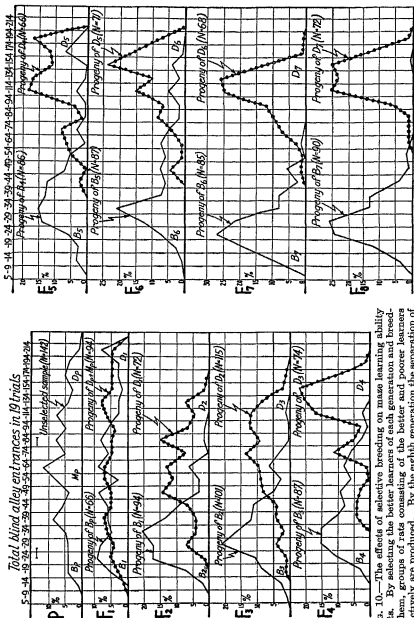


FIG. 10.—The effects of selective breeding on maze learning ability in rats. By selecting the better learners of each generation and breeding them, groups of rats consisting of the better and poorer learners respectively are produced. By the eighth generation the separation of the two stocks is practically complete. Each group, however, shows an approximation to a normal distribution of ability, suggesting a multiple gene basis of the trait. (From R. C. Tryon, "Individual Differences," in *Comparative Psychology*, edited by Moses, Prentice-Hall, Inc., 1934.)

have been made, so it is necessary to refer to an experiment on the lower forms.

✓ An experiment on the selective breeding of rats indicates that improvement can be achieved from generation to generation(6). The intelligence, or learning ability, of the rats was tested by ascertaining the effectiveness with which they ran a maze.<sup>1</sup> The rats with which the experiment began were unselected and had ability that ranged from the very low to the very high. By breeding the best learners together and also the poorest from generation to generation, Tryon studied the effect of selective breeding. By the eighth generation, the two groups are almost entirely separated, and the average ability of the group resulting from the selective breeding of the better learners is much better than the average of the original group; correspondingly, the average of the poor group is much poorer than the average of the original group. Figure 10 contains the curves showing how differentiation increases from generation to generation. By selective breeding of the better learners, the poorer half was almost completely eliminated, and the better half was eliminated by breeding the less "intelligent" rats. The important fact should be noted that the limits of the best and of the poorest remained practically constant.

This experiment indicates that possibly human stock could be improved or deteriorated correspondingly. If only the superior people had offspring, the average level would rise considerably, but if only the inferior had children, the average level would go down. In both instances, the range of ability would be greatly reduced.

The problem is not so simple as it appears from Fig. 10, as only one ability or trait was involved in this experiment with rats. In human beings, we are concerned not only with intelligence but also with health, emotional stability, and various other traits, such as industry and reliability, that contribute to social adjustment. These many factors complicate the problem; but still it is likely that selective breeding would in a few generations improve the race greatly by eliminating a significant proportion of the people born with low intelligence, poor health,

<sup>1</sup> A maze is "a path complicated by at least one blind alley" (Webster). The more capable rats learn to avoid the blind alleys and follow the path that leads to the end of the maze.

and the tendency to develop characteristics that result in maladjustment.

#### FOSTER CHILDREN

Investigations of foster children have yielded evidence concerning the comparative influences of genetic and environmental forces. There are several factors in the lives of foster children that when evaluated help us to understand the variations in the mentality and character of adopted children.

**Quality of Foster Home and Intelligence.**—An important factor in the environmental influence is the quality of foster homes and their differential effect on the cultural and educational development of the adopted children. In a home that is rated high, for instance, the parents are well educated and express themselves in good language; their taste for books and music is highly cultivated; they have a library, a radio, and a telephone. They are concerned for the development of their foster child and, in general, provide that child with advantages. Such a home is located in a community where the foster child has excellent recreational and educational opportunities and where forces making for delinquency are at a minimum. Those homes having the least of these desirable qualities enumerated are rated lowest, and ratings in between the extremes are based on the extent to which the homes possess those characteristics that contribute to the cultural and educational development of the foster child.

Another important factor is the age at which the children are placed and the length of time that they have lived in their foster homes. It is expected that those who were adopted in infancy would be more influenced by their new environment than those adopted at a later age. Several studies have been made to discover the effects of length of residence on abilities and behavior. The data are not entirely clear and conclusive. The detailed data themselves will not be presented; but, in general, conclusions that are not too controversial will be briefly set forth.

The I.Q.'s of foster children in the better homes have a tendency to be higher than those of foster children in the poorer homes. This fact, of course, is not conclusive and for some is not even convincing evidence that intelligence is increased by favorable home environment. It is possible that the foster children in the best homes have higher I.Q.'s because the parents in such homes

are the kind who would be more careful in selecting their foster children than were those from the poorer homes who are less educated and probably choose a child for a superficial reason, such as eye color, dimples, or general winsomeness.

Even though selection may account in some part for the fact that the brighter children are in the best homes, still the factor of home influence on mental ability cannot be ignored. All investigators grant that a favorable home environment will influence the children reared in that environment so that their general abilities will be higher than those of children raised in an unfavorable home environment. The difference at most is hardly over 15 or 20 points in I.Q., and it is doubtful that such a difference represents a true and permanent superiority. It might be overcome if those raised in untoward circumstances were placed in an enriching environment. Nevertheless, when the importance of home environment is interpreted in terms of its effect on character, personality, and health as well as intelligence, it cannot be minimized.

The relation of the quality of the home and the measured intelligence of the foster children is closer for those who have been in their homes longest. This relationship exists to some extent even at the time of adoption, thereby reflecting differential care in selection, but the relationship increases with increased residence. In other words, as adopted children live in their homes, they tend to reflect more the quality of that home. The foster children in more desirable homes tend to increase their I.Q.'s more than do those who were adopted into homes of fewer educational and cultural advantages.

If the foster home has a favorable influence on the mental ability of the adopted children, then those who have been in their foster homes longest would have higher intelligence than the foster children who had been there a shorter time. In other words, there would be a relationship between the length of time the children have lived with their foster parents and their measured mental ability. The studies indicate that there is, in fact, a slight relation between those two factors. The correlation is not high but merely suggestive of such a relation.

**Intelligence of Siblings and Length of Time of Separation.**—It often happens that brothers and sisters are adopted into different homes. If the home environment influences measured mental

abilities, then the siblings who have been separated a longer time will be least alike. It is generally accepted that mental abilities of siblings correlate to the extent of about .40 to .50. The correlation between the mental abilities of siblings reared in different homes is less than the usual correlation; and for those who have been separated over seven years, the extent of relation is less than half as much as it usually is for brothers and sisters. Being reared apart in different environments causes brothers and sisters to be less alike, and the usual similarity decreases with an increase in the years of separation.

**The Behavior of Foster Children.**—The parental background of adopted children who have been studied is decidedly unfavorable compared with that of other children. The true parents of many foster children were predominantly bad—feeble-minded, delinquent, and socially inadequate. The family origin of many foster children is a typical Jukes or Kallikak background. The behavior and school histories of foster children indicate whether or not the influence of their adopted homes tends to overcome their family inheritance. If the children have inherited a definite potentiality for social deficiency, it is important to know if, in a better environment, they become better than their true parents.

It is conceivable that human beings inherit physiological systems that predispose them to unsocial behavior. No doubt some of the foster children inherit a defective nervous system and are thereby predisposed to forms of reaction that constitute unlawful behavior. Even though more behavior problems exist among foster children than among children as a whole, nevertheless the evidence indicates that the adopted children represent, on the average, a great improvement over their parents where these have been criminal or otherwise antisocial. Because many of the foster children, doubtless, are well controlled and conditioned by their homes, they do not follow the pattern of conduct of their true parents to so great an extent as might be expected.

**School Progress of Foster Children.**—The school progress of foster children may be interpreted as indicating the limits of the effects of environmental and hereditary forces. Some data indicate that through the elementary school, the foster children succeed a little better than average. Not so many of them are accelerated, but more of them are making normal progress, and fewer are retarded. In general, the foster children progress a

little farther in grade school than do other children. Their success there may be attributed in part to the care and solicitude that the foster parents have for the children whom they have adopted, so that these children, more than other pupils, are working more nearly at maximum capacity.

In high school, however, the situation changes. The foster children are unable to make so much progress as other children. At a higher educational level, which selects better students and requires a higher order of performance, the foster children can not do so well as they did at the grade-school level. Apparently, at this higher educational level, foster children with their unfavorable family backgrounds reach their limit. At the grade-school level, the sustaining influences of the foster home help them to progress more than they otherwise would do; but at the high-school level, their capacities are not adequate, and home influences cannot overcome their limitations. Probably, their genetic deficiency fixes limitations on their capacities and invalidates their efforts at the high-school level. Very likely, the general principles are that a person of limited ability may be successful at a simple or elementary level if he is helped and encouraged to work to his full capacity; at higher levels, however, where the tasks are more difficult, he cannot be successful no matter how much he is encouraged and taught. Conceivably, heredity fixes each person's limits, but environment is important in determining how effectively a person will function within that limit and how nearly he will reach it.

**Summary.**—The study of foster children indicates that the quality of environment is reflected in their mental abilities, behavior, and school progress. In a favorable environment, their intelligence as measured by mental tests is increased a little; their behavior is better than that of their true parents; and their school progress is improved until a school level is reached where progress is checked by limitations in native capacity. The home influence is not great; it does not transform a child but does affect him, more or less favorably.

**The Iowa Studies.**—A number of studies carried out in Iowa, often referred to as the *Iowa studies*, indicate that certain training and educational features are particularly influential if children are exposed to those influences during their preschool years (7, 8, 9, 10, 11, 12, 13, 14). Some of the findings seem a bit extreme and

have little or no parallel in the work of other investigators. For example, orphan children newly placed in a favorable environment showed gains over a period of 20 months of 21.5 points in I.Q. Two preschool subjects, for example, gained 31 points over an interval of 20 months, thus changing from the status of dull normal to superior. Five control subjects, who did not have the advantage of well-conducted nursery-school training, lost 15.4 points, and their status changed from dull-normal to feeble-minded.

Other results of the Iowa studies show the direct influence of institutional environment on children's abilities. The children investigated lived in an orphan's home and in institutions for the feeble-minded. Children living with a group duller than themselves tend to be dragged down in intelligence; conversely, when morons are placed with normal children, the morons tend to increase in their abilities. The trends are not very large but are consistent. The younger orphanage children tend to lose in I.Q. with continued residence in the orphanages. In other words, children tend to change to the mental level of the group in which they are members.

In the retesting of preschool children, it is discovered that those who attend nursery schools show definite gains in the abilities measured by the tests. Gains made during the winter months were about twice as great as those made during the summer vacation months.

The most unusual finding reported was that of the influence of preschool education on later abilities, extending to the college age. The preschool group had relatively better standing in the intelligence test at the time of college entrance than they had when they were tested as preschool children, and the standing at the time of college entrance was relative to the length of attendance in the university schools. This is a most unusual finding, showing the influence of early and good schooling on mental abilities, which were measured many years later. The value of early training, according to this study, manifested itself even during college years.

A most unusual case was that of a child entering a preschool who when first tested had an I.Q. of 98, at the age of three; retested at four years, an I.Q. of 109; at five years, 126; at seven, 125; and at ten, 153; when he entered college, he was in the best

10 per cent on the college entrance examination. This child had increased 55 points in I.Q. between the ages of three and ten.

It has also been found in the Iowa studies that children who were of very unfavorable and probably inferior stock when placed in good foster homes were found to develop to a level of superior intelligence.

The findings are consistent in showing that preschool education has a marked influence on the measured intelligence of children; that association of a child with children of higher mental level increases the I.Q. of that child and association with children of a lower mental level decreases the I.Q. of that child; and also that when children are placed in good foster homes their measured mental abilities are increased, in some instances a phenomenal amount. Also, in the typical orphanage environment, there is a tendency for the I.Q. to decrease. The Iowa findings are rather unusual and have little corroboration in the researches of others. Still, these studies make us conscious of the possibility that mental ability and possibly mental capacity are not fixed but are dynamic in nature and responsive to environmental influences. At least because of the conflicting evidence, we must not be too dogmatic and positive in our points of view.

#### IDENTICAL TWINS REARED APART

##### **Difficulty in Evaluating Heredity and Environmental Forces.—**

It is exceedingly difficult to separate out the specific effects of environmental and hereditary forces. The many investigations that have been made give rise to conflicting interpretations. It has been impossible to control the environment for a large number of people so strictly that all differences can be safely ascribed to heredity. Nor has heredity been held so constant that the effects of differences in training and opportunity could be evaluated. The complexity of the problem has prevented controlled investigations of the measurable effects of nature and nurture.

Possibly the nearest approach to a controlled study of the influence of nature and nurture is the study of identical twins who have been reared apart from infancy. These cases provide an opportunity for studying the effect of different environments on children basically similar.

It is assumed that in the case of identical twins the heredity is nearly constant. Developed from the same germ cells, they



are called *monozygotic* and are very much alike physically and mentally. It is this identity of cell structure that provides the basis for assuming nearly complete constancy or similarity of hereditary factors.

Studies have also been made of identical twins reared together, and facts have been collected that indicate the extent of similarity between them. Thus, the pattern of differences found for identical twins reared in different environments can be evaluated in terms of the data pertaining to twins brought up together. The extent to which dissimilarities of twins reared apart exceed the dissimilarities of twins reared together may be reasonably attributed to differences in the environmental stimuli that have influenced the twins who have been raised in different environments.

Many twins, classified as identical, are so much alike, at least during their early years, that they can hardly be told apart. They may, according to some interpretations, be considered two editions of the same person. Identical triplets are very much alike also. The identity of identical twins or triplets can be illustrated by a story about the latter. Two of the identical triplets connived with the third that she fool the nurse so that two of the triplets be allowed to spend more of the evening in play. According to the plan, the one triplet permitted herself to be bathed and put to bed three times in order to lead the nurse to believe that she had put all three to bed. One can, of course, exaggerate the similarities of identical twins and triplets. Careful observations and measurements do reveal that in a few instances those classified as identical vary considerably in some respects.

Valuable data on twins have been collected by Newman, Freeman, and Holzinger(15). These investigators studied 19 pairs who had been separated either during infancy or in early childhood. Each pair had as identical heredity as it is possible to have, but each twin had lived in a different environment. The investigators believed that if the individual members of these pairs of twins were found to differ more than did identical twins reared together, the causes of such differences could reasonably be ascribed to the different environmental forces to which they had been exposed.

The data of Newman, Freeman, and Holzinger have been analyzed to discover differences and similarities in the identical

twins reared apart that will tell us what changes the environment may make in people. The history of some twins shows that health and physical characteristics are affected by one's mode of living; that of others indicates that temperament and mental ability also reflect differences in environment.

Only a comparatively small portion of the detailed statistical data will be presented. A sampling of the results will be described to illustrate how the twins have been affected physically, temperamentally, and intellectually.

**Physical Characteristics.**—A pair of twins separated at five months of age were reared on farms about 100 miles apart. The girls were reported to have been extremely similar at the age of seventeen; but at twenty-nine, when they were carefully studied, they were very different. Mabel, who did vigorous outdoor farm work, had become rugged and muscular. Mary, on the other hand, for the six years preceding the investigation had lived in a small town where she had clerked in a store during the day and given piano lessons in the evening. The two sisters were quite different in their appearance. Mabel, who was 1.5 inches taller than Mary, weighed 138.5 pounds and was sturdy and masculine. Mary weighed only 110.75 and was delicate and feminine.

But farm life in itself does not always cause the rural twin to be healthier and sturdier. Another pair of twins, Fay and Edith, had been separated when they were fourteen months old and temporarily reunited at the age of sixteen. Fay married at twenty-one, and Edith at twenty-three. Fay had a comfortable married life. Edith, on the other hand, largely by her own efforts, farmed a North Dakota claim, doing most of the work herself, for her husband was away much of the time. Two children were born during this period.

At the age of thirty-eight the twin who had experienced a comfortable, happy wedded life was in much better physical condition than her sister on the farm. The former weighed 8.5 pounds more. Her teeth were in perfect condition, but the teeth of the twin who had lived a life of hardship were discolored, decayed, and worn, and some were missing. This condition quite probably may be ascribed to inadequate food during pregnancy and to the lack of dental care.

The health of another pair of twins who had lived in different environments tells a similar story. One had lived on a farm in

the "goiter belt." She had not included in her diet iodized salt and seafoods, which tend to prevent goiter. She had a pronounced goiter, was heavier than her sister, and became fatigued easily. The other twin spent her adult life in a large city where her diet included foods that prevent goiter. She was not so obese as her sister and had much more energy and strength.

These cases indicate that health is dependent to a high degree on the proper food, suitable exercise, and freedom from over-exertion and other taxing burdens. From time to time, somebody supports the doctrine that health is fixed by heredity and that it is a waste of effort to attempt to control it through a sensible diet, general moderation, and a careful regimen. But such doctrines are misleading. We shall do well to do as much as we can to provide hygienic conditions for ourselves. Parents more than anyone else can influence the child's health, for they can aid him prenatally as well as postnatally through sensible diet and care.

4. **Temperament.**—Even though it may be quite readily granted that the shape of the head and nose, for instance, is largely determined by the germ cells, it is also generally conceded that personal characteristics and qualities closely associated with habits and attitudes are influenced more than a little by experience. Even the most violent hereditarians are apt to grant that personality traits are possibly more influenced by the circumstances of life than are characteristics known to be more structural in their nature.

As part of their study, Newman, Freeman, and Holzinger tested the personality of twins and interpreted their test results in terms of the environment in which the separated twin had lived. When the twins had had almost the same type of home life and also had had similar experiences, their responses to the items on the personality test were much alike. When their training and experience had been decidedly different, their personalities were unlike.

For example, one of a pair of twin boys had been brought up in the city, and the other had lived in a rural community. One was found to be "citified," whereas the other was "countrified." The former was more dignified, reserved, self-contained, unafraid, and experienced and less friendly. The country boy was naïve, less dignified, and laughed readily.

In the case of the two sisters mentioned earlier, of whom one had led a comfortable life while the other had struggled for a livelihood on a North Dakota farm, it was found that the latter exhibited more worries, greater sensitivity to unpleasant ideas, and less emotional stability.

On the other hand, though environment causes differences in identical twins, similarities persist in them. A careful analysis of the data reveals that twins reared apart are in many cases surprisingly alike according to the tests of temperament and personality. Of course, such data are hard to interpret, because personality tests have not yet reached a very high state of development. Consequently, they are not always strictly accurate, but that fact makes the similarity of personality traits in the compared twins even more remarkable.

**Effect of Environment on Measured Intelligence.**—The relation of environment to general intelligence can be described more exactly than the relationship between environment and health or between environment and personality. The exact educational record of each twin was easily obtained, and the quality of the home was determined fairly accurately also.

Apparently, the clearest environmental effect is on the type of intelligence that is measured by tests. Almost invariably, the twin of a pair who had had considerably more education than the other or had been brought up in a more stimulating home obtained a higher mental and educational rating. When twins had had approximately the same educational opportunities, their scores on mental and educational tests differed very little.

One twin was reared in a home where the parents were nearly illiterate. Having dropped out of school at the age of eleven, she had had no education beyond the fifth grade. Her sister was graduated from high school and then taught school. She had seven more years of education, but her home environment was hardly better than that of her less educated sister. According to mental tests, the more educated twin surpassed her less educated sister by about 2 years in M.A. and 12 to 15 points in I.Q. Educational achievement of each twin was measured by the Stanford Achievement Test, and the girl with more education surpassed her sister by 3 years 2 months.

Of the twins Mabel and Mary, who were mentioned earlier, physically Mabel was much better developed than Mary, but

Mary showed greater intellectual ability than her more rugged sister. Mary, however, had finished high school, whereas Mabel had dropped out of high school after only six weeks of attendance in order to assist her foster mother on the farm, taking care of the baby and helping with the chores. Mary's postschool experiences were more stimulating intellectually than Mabel's; she clerked in a store and in the evening taught piano pupils. In M.A., she exceeded Mabel by nearly 3 years and in I.Q. by about 20 points. The difference in educational age as determined by the Stanford Achievement Test was also about 3 years. The difference between these twins in both educational and mental ages was about the same.

It appears from the data on this pair of twins and others that intelligence-test scores reflect educational and home advantages to about the same extent that educational-test scores do. Psychologists have, for the most part, contended that mental tests measure the manifestations of native capacity whereas educational tests measure to a greater extent the products and extensiveness of training. The investigation of Newman, Freeman, and Holzinger suggests that the tests reflect differences in environmental stimuli to about the same degree. Persons reared in intellectually fertile environments will score considerably better on both the mental and the educational tests than will individuals of comparable capacity who have grown up in an impoverished environment. It must be added, however, that some separated twins brought up in markedly different surroundings and with different educational opportunities were unexpectedly similar in their test scores.

In Table VII are given some correlations of various traits and abilities for identical and fraternal twins reared together and for identical twins reared apart. It can be observed by comparing these coefficients of correlation that identical twins reared together and those reared separately correspond about equally in their physical traits. An exception is weight, in which identical twins reared separately show less correspondence than do those reared together. There is least correlation of physical traits among fraternal twins.

On the basis of these data, it may be concluded, because of the similarity of the coefficients of both unseparated and separated twins, that physical traits are least influenced by environ-

mental factors. Such a conclusion may apply to the more structural traits; but it must not be applied to physical condition, or health. It may be that differences in environment will not affect length and width of the head but will result in poorer or better health. A number of separated twins showed rather marked difference in their general physical condition. Consequently, one should not generalize too broadly on the basis of the data given for physical traits listed in Table VII.

TABLE VII.—CORRELATIONS FOR THREE GROUPS OF TWINS\*

| Trait                          | Identical | Fraternal | Separated |
|--------------------------------|-----------|-----------|-----------|
| Standing height . . . . .      | .981      | .934      | .969      |
| Sitting height . . . . .       | .965      | .901      | .960      |
| Weight . . . . .               | .973      | .900      | .886      |
| Head length . . . . .          | .910      | .691      | .917      |
| Head width . . . . .           | .903      | .654      | .880      |
| Binet M.A . . . . .            | .922      | .831      | .637      |
| Binet I.Q . . . . .            | .910      | .640      | .670      |
| Otis I.Q. . . . .              | .922      | .621      | .727      |
| Stanford Achievement . . . . . | .955      | .883      | .507      |
| Woodworth-Mathews . . . . .    | .562      | .371      | .583      |

\* After Newman, Freeman, and Holzinger, 1937.

The correlations for mental and educational abilities as given for Binet mental age, Binet I.Q., Otis I.Q., and Stanford Achievement are decidedly lower for the separated than for the unseparated identical twins. The correlation for the fraternal twins is both higher and lower than that for separated identicals but not so high as for identical twins reared together. A comparison of the coefficients of the two classes of identical twins will indicate in a general way how educational and cultural advantages or disadvantages influence mental and educational abilities.

The correlations for the Woodworth-Mathews test may not be very meaningful. This test purports to measure psychoneurotic tendencies—worry, fears, and various complexes—and possibly is not reliable enough to provide satisfactory data for a study involving only 19 pairs of separated twins. Consequently, one is on safest ground if he does not try to explain why there is a higher correlation for the separated than for the unseparated identicals in the case of this test.

Only selected bits of evidence have been given; but in general, this extensive study of twins reared apart from infancy indicates that variations in the favorableness or unfavorableness of the environments are reflected in physical well-being, personality traits and intellectual traits. It may determine health or illness, strength or weakness. It may, under some conditions, make people distressed and worried; under others, confident and happy. Cultural advantages in the environment affect mental and educational abilities to an extent representing several years of mental and educational development.

These differences are probably not permanent. They could be overcome, perhaps, if less favored individuals were given the proper advantages; but those whose abilities are less developed will be handicapped if they do not develop their potentialities. Some people may hold that a person will develop his potentialities to the extent required by his needs and that each person, in the natural course of events, will develop to an optimum level. Observation, however, has shown that such a point of view is not tenable, because environments may starve or nourish native capacity. Consequently, educators should be seriously concerned with producing for everyone a most favorable environment.

**THE YOUNGEST CHILDREN IN A GRADE ARE THE MOST CAPABLE,  
AND THE OLDEST ARE THE LEAST CAPABLE**

The most striking corroboration of the fact that children are born with different potential capacities and that no quantity of environmental forces will equalize and overcome those differences lies in the comparative ages and abilities of the youngest and oldest in a given class. The following outline of data shows the comparative mental ability of two groups that differ widely in age and years of schooling.

COMPARISON OF THE 15 YOUNGEST AND 15 OLDEST BOYS IN A HIGH-SCHOOL CLASS\*

|                     | Average<br>age, years | Average number of<br>years of schooling | Average<br>M.A |
|---------------------|-----------------------|-----------------------------------------|----------------|
| Youngest... . . . . | 11.7                  | 5.7                                     | 16.7           |
| Oldest..... . . . . | 15 8                  | 9.4                                     | 15.1           |

\* Data were provided the author by Royal Embree, Jr., of the University of Minnesota High School.

The M.A. of the group of younger students is higher, as indicated by their higher intelligence-test scores. The younger boys have lived slightly over four years less than the older boys and have been in school nearly four years less. In other words, the older boys have received much more instruction and have had more years in which to learn from experience. Though lacking that "additional environment," the younger boys score higher on all the mental tests. The extent of their superiority on the mental tests is equivalent to 1 year 7 months of M.A. Here is a younger group having lived four years less than the older one, having had nearly four years less of formal education, and still scoring so much higher on mental ability tests that their M.A. is 1 year 7 months above the level of the older group. The evidence seems to indicate that the differences between the youngest and oldest children in the class exist, for the most part, because the younger children are born superior to the older ones. In spite of the additional amount of education and years of living, the older pupils are inferior to the younger. Furthermore, the younger children will continue to develop at their more rapid pace and at adulthood will be farther ahead of the dull children than they are now. The dull children will never catch up to the bright ones, for their different rates of growth will continue until maturity is reached.

Data such as these are rather convincing; differences in the quality of human organisms apparently are real. The younger boys, for example, have nervous systems that receive stimuli and retain them. When placed in a situation calling for response, they respond better in terms of truth and fact than do the older boys. In this connection, it may be added that educators are particularly interested in the inherited qualities of the nervous system that affect its ability to receive, understand, and respond to stimuli.

#### EDUCATIONAL OPPORTUNITY AND ABILITY

**School Attendance and Mental-test Ability.**—Is there any relation between extent of school attendance and the abilities measured by mental and educational tests? For example, will the child who has attended school relatively little have less mental-test ability than one of the same age who has attended a normal length of time? To some, it seems obvious that he should; but



others maintain that school attendance does not matter much in the development of mental abilities. Answers to these questions, however, may be found in an investigation by Gordon, who studied the effect of school attendance on mental abilities and educational achievement(16).

Included in this investigation were four groups: the physically defective, gypsy, canalboat, and retarded children. The ability of these groups was related particularly to the extent of their school attendance and their ages. Most of them, for various reasons, did not attend school so regularly as most children do. The physically defective obviously are frequently out of school. Gypsy children wander about the country with their nomadic parents; and canalboat children, who live on the boats, can attend school only when they dock long enough to permit them to go. The backward children were dull children found in the special classes organized for them.

The fundamental point to consider is the relation between school attendance and mental and scholastic ability. If children do not attend school, do their "native" abilities as measured by mental tests deteriorate? That a student's ability in school subjects suffers from non-attendance is a matter of common knowledge, but it is of particular significance to compare the effect of different amounts of absence from school on the abilities measured by both intelligence and subject-matter tests. Such a comparison should shed light on the importance of environmental influences on general mental and educational abilities, of which the former are often assumed to be native and the latter more subject to school training.

Table VIII, compiled from Gordon's data, shows the relation of mental and scholastic abilities to school attendance. *Mental ratio* is a term having the same meaning as the term *intelligence quotient*. The educational ratio is the same as the educational quotient, which is obtained by dividing educational age by chronological age. For the three groups, omitting the backward class, the ratios, or quotients, tend to correlate with the percentage of school attendance. The backward class obviously should be omitted from such comparison because it is not comparable with the others, having been selected for backwardness rather than for school attendance. The canalboat group, the one with the least school experience, had the lowest quotients, and

the physically defective, the group with most attendance of the three, had the highest quotients.

TABLE VIII.—MENTAL AND SCHOLASTIC ABILITY OF DIFFERENT GROUPS, WITH THEIR PERCENTAGES OF SCHOOL ATTENDANCE\*

| Group                        | Average mental ratio (I.Q.) | Average educational ratio (E.Q.) | Average attendance by percentage |
|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| Physically defective ..      | 86.7                        | 86.9                             | 48.0                             |
| Gypsy children. . . . .      | 75.4                        | 77.4                             | 34.9                             |
| Canalboat children . . . . . | 71.5                        | 71.6                             | 5.0 (estimated)                  |
| Backward class . . . . .     | 74.9                        | 76.9                             | 67.5                             |

\* Based on Gordon, 1923.

The mental ratios (I.Q.'s) of these groups were below average, a fact that is true also of their educational ratios. Strikingly, the mental and educational ratios correspond very closely for each of the groups.

The data in Table IX bring out the striking fact that the mental ratios, or I.Q.'s, of the older children of the gypsy and canalboat families are lower than the mental ratios of the younger ones. Table IX shows the I.Q.'s according to the ages of the children from the same family. It can be seen from this table that the I.Q.'s of the older brothers and sisters are considerably lower than those of the younger ones. This variation, however, can probably be explained in terms of the amount of school experience. The abilities of the youngest children are determined on the basis of the performance of children who have had little more

TABLE IX.—INTELLIGENCE QUOTIENTS OF CANALBOAT AND GYPSY CHILDREN ACCORDING TO AGE\*

| Age | Canalboat children | Gypsy children |
|-----|--------------------|----------------|
| 6   | 86                 | 95             |
| 7   | 79                 | 81             |
| 8   | 76                 | 78             |
| 9   | 73                 | 76             |
| 10  | 68                 | 74             |
| 11  | 64                 | 72             |
| 12  | 59                 | 71             |

\* This table has been based on curves found in Gordon, *Mental and Scholastic Tests among Retarded Children*, p. 54

school experience than the gypsy and canalboat children. A six-year-old child of ordinary school experience has not had much more schooling than have gypsy or canalboat children of the same age. Consequently, the effects of irregular attendance are not

yet very evident. The older children, however, have much lower I.Q.'s, because their I.Q.'s are being based on norms made by children who have attended school the usual amount of time over a period of several years. On this basis, the older pupils are penalized by norms based on the performance of children who have had several years of schooling.

In line with this observation, it is noteworthy that after the age of seven the mental ratios of the canalboat children decreased more than did those of the gypsy children. This difference may have been caused in large part by the fact that canalboat children attended school considerably less than did gypsy children.

**Mental and Educational Ratios.**—An inspection of the mental and educational ratios for each group reveals that they are strikingly similar. Apparently, absence from the stimuli of formal education affects the abilities measured by mental tests as well as scholastic ability. These data indicate the potency of education and also suggest that abilities measured by mental and scholastic tests are really much more alike than is ordinarily supposed.

It is obvious that for the physically defective, gypsy, and canalboat groups, ability follows amount of school attendance closely—the greater the school attendance the higher both mental and scholastic abilities. The abilities of the gypsy children are about the same as those of the backward class; but the abilities of the canalboat children, who attended school less than either of these two groups, are even lower.

One possible explanation of the intellectual inferiority of the gypsy and canalboat children is that they are actually inferior to normal children. It may be said that they come from inferior stock and, hence, are genetically inferior. These statements may fit the physically defective also, but the facts hardly support such an implication when applied to the canalboat and gypsy children. The children of the latter two groups seemed well nourished and were of normal physical development.

The evidence indicates that gypsy and canalboat children are inferior largely because of limited educational experiences. The preponderance of evidence is that those abilities measured by mental and educational tests were stunted because of extremely limited school attendance. For the gypsies there is a correlation of .28 between mental ratio and amount of school attendance;

between educational ratio and attendance, the correlation is also .28. This correlation is significant in view of the fact that other factors, such as basic intelligence and age, vary within the group and thus affect the correlation. This coefficient of correlation indicates, however, that a tendency exists for greater intelligence and scholastic ability to be associated with more school attendance.

The most telling bit of evidence that the development of mental ability, as it was measured, is dependent on schooling lies in the relationship of age and I.Q.'s. There is a substantial negative correlation between them. It is  $-.75$  for canalboat children and  $-.43$  for the gypsies. These correlations suggest that, in terms of the norms based on children whose school attendance is normal, older canalboat and gypsy children tend to have lower I.Q.'s than the younger ones. These data indicate that, with continued living devoid of adequate schooling, the mental ratio, or I.Q., goes down with age.

**Variations in Average Mental Ability of Soldiers from State to State.**—During the World War, the United States soldiers were tested with a mental test known as Army Alpha. On this basis, it was possible to determine the average mental abilities of the soldiers from each of the states. The average mental abilities of the soldiers varied from state to state; and in some instances, the differences in the average scores were large.

Investigators were interested in discovering a possible explanation for these variations from state to state, and some have found it in the quality of state school systems. States differ considerably in the average quality of their schools. Some offer their children better educational facilities: the teachers have higher qualifications; the school terms are longer; and the school equipment is superior. The quality of the state school systems has been evaluated according to these and other factors.

A comparison of the rating of the schools of the states with the average standing of their soldiers in the mental tests revealed that there was a fairly high correspondence between the quality of the schools and the tested ability of the soldiers. Thus, the soldiers from the states with the best schools scored highest on the mental tests, whereas those who scored lowest were from the states with the poorest school facilities. This correlation was not perfect, but the trend was very marked.

The foregoing relationship seems to indicate the effect of good schooling on general ability. Accordingly, if the schools of various states are poor, then the mental abilities of the people in those states will most likely be poor; but if the schools are good, then the mental ability of the people will be relatively high.

Another point of view may logically be taken. It is that the schools do not create the intelligence of the people but that the people create the schools. The people who possess less inherent ability or have less intelligence will not demand and maintain such good schools as will the people of superior traits. In other words, the schools are a product of the people, and not the people a product of the schools.

This evidence, like most of the evidence on the contribution of environmental and hereditary forces to human development and capacities, lends itself to dual interpretation. It is probably closer to the truth in this last instance, as well as in others, to recognize that both types of influence are important. In this last case, one may feel quite certain that the mental abilities of adults taken as groups depend to some degree on the quality and amount of formal education that they have had. On the other hand, it is likewise true that people of superior mental abilities will have better schools because they demand them. Cause and effect are not clearly distinguishable. No doubt there is a reciprocal relation between the environmental and hereditary factors; one reacts on the other.

#### INTREPRETATIONS AND APPLICATIONS

It is apparent from the lines of evidence presented here that education is important for maintaining a higher educational, intellectual, moral, and social level. If fewer people were educated, or if people were educated less, the intellectual level would fall. If all people were deprived of education, their I.Q.'s as now determined probably would drop, on the average, 30 or 40 points. This decrease would represent a considerable loss of human resources.

The contemplation of the difficulties into which we might get if our intellectual resources diminished materially leads us to appreciate the significance of all the environmental forces that maintain or increase the general mental level. Should our

developed intelligence be impaired seriously overnight, to an extent represented by an average decrease in I.Q. of 40 points, our cities would soon become large pockets of chaos and confusion. Transportation systems would be dislocated. Food would spoil because the problems of preserving and distributing it would be too complicated for us. Our automobiles, if we could run them, would soon cease to serve us, for there would be few who would understand how to repair them. Gasoline supplies could not be replenished, as the process of refinement could not be grasped and would be forgotten. Automobile factories would not turn out automobiles, because the creative intellects behind the machines would then be so much poorer that they could not master the intricacies of the machinery.

The upper ranges of our curricula would be closed to the human mind. Simple arithmetical functions would be our higher mathematics. Simple computation would be the achievement of the mature mind.

We have assumed that the educational forces in life—formal education; books, newspapers, and magazines; lectures; etc.—would become so meager for each individual that his mental abilities would be considerably reduced. Still, we should have the same potentiality of mental power even though it were not developed. This would no doubt reassert itself in time and rediscover the truths that we now have; but it would take decades to bring back all the knowledge that now enables us to combat disease, utilize our natural resources, and control our relations with each other.

If instead of the external loss of developed intelligence our inherited capacity were reduced by one-half overnight, then also would arise the chaos that has been described, but it would probably be more serious, for in that case there would be little hope of raising the general intellectual level above the limit set by the native endowment of the people.

Emphasis should not be placed on either the environmental factors or the hereditary forces to the exclusion of the other. Both are exceedingly important. Human stock should be improved genetically, but it should also be well taught. Potential capacity that is ignored and neglected will contribute nothing to the development of the individual or to the improvement of the social group. This point can be illustrated by the hypo-

thetical case of twin brothers of average ability separated in infancy. One is placed with a family locked in a mountain valley; the other, with a good family in a progressive American city. The one will become an illiterate mountaineer. He will know nothing of national events. Intellectual growth as measured by mental tests will show little increase after seven or eight; he will have an I.Q. of 60 or 70. His children—and they will be numerous in spite of the high infant mortality—will have I.Q.'s like their father's, even though potentially they may be average.

The twin raised in an up-to-date city will go to school and will probably graduate from high school. He may even go to the city's junior college. Having only an average intellect, he probably will not graduate from a four-year college. Nevertheless, his education will be well above the average for the American people. Very likely he will have acquired habits of industry and an ambition for personal growth and advancement, and he will eventually become a respectable self-sustaining citizen. If he and his wife are interested in providing a good cultural environment for their children, the children will be likely to have better I.Q.'s than their father and may develop to a point higher than the one their father finally reached. And if their mother was actually or potentially superior to the father, the chance of these children's having a high average of intelligence would be even greater.

It is not claimed that environment within normal limits affects the germ cells. The best evidence indicates that the germ cells create the organism and determine its potentialities. The environment is the force that decides the extent to which one's potentialities will be realized. This environmental function, however, is very important because it may cause a range, or difference, in intellectual development that can be symbolized by an I.Q. of 110 on the one hand and possibly 80 on the other. It may also mean a strong, robust body or one that is anemic and afflicted with aches and pains. It may determine whether a person will be happy and confident or shy and fearful. Still, no type of environment will give a moron average ability, nor will it develop a person of average muscular development to a point where his picture will qualify to advertise courses in physical culture. Educational advantages, nutrition, medical care, physical training, and other environmental factors can

develop and improve, but limits that vary from person to person are probably fixed genetically. The environment "can mold but it cannot create."

**Selective Character of Environment.**—Two psychologists riding in a train were discussing the relative contribution of heredity and environment to human development. As they looked out of the train window, they saw in a cornfield a man driving two horses hitched to a corn cultivator. One psychologist asked the other (no doubt having forgotten that according to popular notion every corn row leads to the White House), "Even if he has marked ability, what chance has that man of achieving greatness?" The other psychologist stated that if the man had high ability, he would be so restless in his present environment that he would throw the lines over the horses' backs and seek an environment compatible with his abilities.

For the extremes of ability, this statement is essentially true. It is probable that a person who has transcendent talent for music, sculpture, mathematics, or poetry will not be denied. Such a person will utilize all possible experiences to manifest his ability; and when he finds that his surroundings are not stimulating enough, he will seek a new environment.

An experience of Isaac Watt's, the great hymn writer, illustrates the persistence of some abilities in spite of adverse circumstances.<sup>1</sup> When he was a child, his unabating versifying annoyed his mother, and she attempted to discourage him with a spanking. He pleaded during the process:

*Oh mother, on me pity take,  
And I will no more verses make!*

At the other extremes of ability we have those who are so limited that no matter how advantageous the environmental stimuli, they will gravitate toward their natural condition at the first opportunity. Such people cannot be put into a good home without its soon becoming untidy and run down. Though they are given any number of jobs, they will fail in all of them. If closely controlled, they seem to get along a little better; but as soon as the props are removed, they revert to their vegetative state. If it were not for the disciplines of social control, they would become delinquents and social problems. Such persons

<sup>1</sup> Reported by Popenoe, *Journal of Heredity*, 20: 422.



are so heavily laden with liabilities that they gravitate to the bottom. In contrast are those so richly endowed that they rise to the top.

**Native Capacity and Environmental Influence.**—Figure 11 is included to illustrate the variation in accomplishment according to position in the range of human capacity from level *A*, the highest, to *E*, the lowest. We shall assume that the various levels of capacity, or potential achievement, are fixed by the germ cells. Then the arrows going out from any level indicate the position that a person will take because of environmental influence, some taking a higher position and some a lower one.

For example, if people are born with average health, some will be very well cared for and consequently will have better than average health, whereas others will have poor care and will be considerably under average. It is doubtful that any one of them, no matter how good the care, will have health equal to those few at *A*, who are born with a high degree of resistance to all illnesses, become men of great energy, and live to be over ninety. Again, those who are born at the *E* level, with severe constitutional weaknesses and a definite predisposition to disease, will quickly die if neglected but may survive at least for a little while if given the best medical care.

Similarly, if a person born with high mental capacity and raised in a home of excellent cultural and educational advantages is given the finest training available, his development will be at the level of his potentiality. On the other hand, he may have spent his boyhood days in an impoverished environment; but, ultimately, he will find an environment more compatible with his capacity. The likelihood is that his final development will be less than his potentialities.

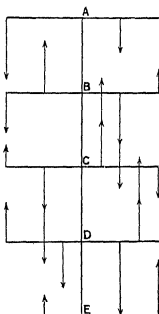


FIG. 11.—Variation in achievement and abilities according to level of capacity.

We are assuming that with average opportunities the person will reach the degree of development at the levels represented, in this instance, between the letters *A* to *E* but not including them.<sup>1</sup> Those with especially fine opportunities and training will rise above, and those with poor opportunities will fall below, the level that is average for them. It is also likely that those at the top, or near the top, can drop down below their average level more than those in the lower levels can rise. In other words, it is more possible for unfavorable situations to operate negatively for those whose potentialities are high than for favorable conditions to operate beneficially for those low in the scale of human capacity. This statement is presented not as a known truth or fact but as a proposition to be analyzed seriously. Furthermore, the range of human capacity probably should be divided further, and the range above or below any given level should be more restricted. Also, a single individual will not be at the same level for all traits and abilities. He will be higher for some than for others. Figure 11 should not be taken too literally, for it is presented merely to suggest that variation of developmental status about given average levels may occur according to the richness of the environment.

**Native Capacity and the Power to Learn.**—If one believes that the limits of a person's capacity to profit from instruction are fixed by the quality of the genes in the parents' germ cells and the order in which the genes combined, he is likely to adopt an educational philosophy consistent with that point of view. He is likely to have a deterministic outlook. He will feel that some are limited by heredity to fewer years of education than others—that although some should have a college education, others should have only a high-school, and still others only an eighth-grade, education. The most gifted, he believes, should be guided by teachers and counselors into the professional schools. A tendency exists among some educators to fix inherent limits of educability for students on the basis of aptitude, or intelligence-test, scores

Serious danger lies in taking too deterministic a point of view. Some pupils from whom only very little is anticipated on the basis of intelligence tests exceed expectations considerably.

<sup>1</sup> Those at the top level of potentiality can hardly exceed but only reach it, and those at the bottom level cannot go below it.

There is a greater tendency to underestimate than to overestimate, to predict failure rather than success. On the basis of intelligence-test scores, psychologists and teachers may decide that some pupils are not capable of completing their high-school work or of maintaining satisfactory scholarship in college. There is, to be sure, a general correlation between test performances and ability to achieve in various school situations; but without the fullest evidence, no one should be dogmatic in any case. Occasionally, a few students succeed very well in spite of the fact that they entered college with poor prospects and with failure predicted for them by nearly everyone. They generally possess special talents and character traits that were either not known or not measurable by the tests given.

Sometimes, a teacher may judge as dull and hopeless a pupil, who is exceedingly capable. Such a pupil shows little interest in his schoolwork and proceeds in his own individual and often peculiar way or devotes a large proportion of his time to activities more to his liking. The busy teacher, judging the child only in terms of the usual classroom standards, overlooks his genius and predicts failure. When in early adulthood he turns out to be a distinguished person, she wonders how a child that seemed so dull in school could have developed so much ability. The fact is that she failed to understand wherein lay his greatest ability and drew a wrong conclusion.

Counselors and others who engage in guidance and decide for pupils that the classes or the kind of schoolwork that the pupils propose to take is beyond their ability are thus in danger of making serious mistakes. They will be correct in the case of many students; but if they are too arbitrary, they will do serious injustice to a number of pupils. Heredity may fix varying limits for each pupil, but the limits for each individual cannot be arrived at accurately enough to warrant the counselor's absolute and determined judgment of every one. We are sure, of course, that a pupil with an I.Q. of 70 or 80 will not become a lawyer; but in less extreme cases, we are not sure that all those who enter college with low aptitude-test ratings will not succeed. A few of those who according to nearly all previous findings are destined to fail will survive the academic rigors, and an occasional one will achieve a comparatively high degree of success. The limits of achievement seem to be affected by such a number of factors

that we cannot be sure of what they are in a specific situation. Most errors can be avoided if those who guide and direct pupils allow, within reasonable limits, a period of trial instead of judging them with absolute finality.

### SUMMARY

The way human beings treat each other is controlled to a considerable degree by their point of view on heredity and environment. We should differentiate, however, and note that some factors and traits are determined more by the force of nature and others more by the force of nurture.

The genes in the germ cells, their quality, and the way they are paired up in the union of the male and female cells determine the traits of the offspring. Some of these traits, such as color of the eye, are hardly influenced by nurture; but general health and various physiological qualities can be influenced significantly.

The principles of inheritance are: like begets like, variation, regression, and the fact that a child inherits from his ancestry in proportion to its nearness. If the germ cells were homozygous, like would beget like with little or no variation; but because they are heterozygous, variation occurs. Regression refers to the trend of the offspring to revert toward the average.

The study of family lineages shows definitely that both distinction and degeneracy runs in families and also that normality, or average, is the rule. Furthermore, the closer the blood relationship the more nearly alike the characteristics. For example, brothers and sisters are more alike than cousins, and children are more like their parents than their grandparents. We cannot be sure, however, of the relative influence of the environment or the hereditary forces, because they are not separated.

Evidence from the animal world indicates clearly that selective mating improves the offspring very much in a few generations.

The quality of the foster home is reflected in the foster children. Their I.Q.'s increase 5 to 10, and in some instances up to 15 and 20 points; and even though their parents are usually inadequate socially and often antisocial, the behavior of foster children, although worse than the average, is much better than that

of their parents. Their school progress reflects the favorable environment of their foster home.

Identical twins reared apart from infancy are not so alike in many characteristics as are identical twins reared together. Their health, mental ability, and emotional life reflect to a greater or lesser degree the differences in the environments in which they were raised.

The youngest child in the grade is the ablest, although he has had much less instruction and much less experience. Still, he has more capacity, thus indicating that some children must be born with much more capacity than others.

When children go to school very little, their mental abilities decline from year to year. The evidence of the canalboat and gypsy children is clear on this point. Related to this evidence is that on the quality of the schools in the different states and the abilities of the people from those states. During the World War, the soldiers from the states with the best school systems tested highest on the average, and those from states with the poorest school systems tested lowest.

The evidence is clear in pointing out the importance of both environment and heredity. It is important to maintain the best educational system; the best health service; the best economic system; and, in general, a society where the forces cause a maximum development of the people. It is equally desirable that the human stock be improved by having the people that are the healthiest, the brightest, and of the best character have most children and that degenerates of body, mind, and character have none.

### Problems and Exercises

1. In dealing with your associates on the playground or the classroom, does it occur to you that they differ in the limits of their capacities? If so, do you think of the difference as having been caused by nature or by nurture?
2. How do you account for the fact that the children in a given family vary considerably in their mental abilities, physical characteristics, and interests?
3. Give as many examples as you can where a distinguished father or mother in industry, science, music, philosophy, athletics, or any other field has a son or daughter as great as he or she. Give examples of

instances where the children are not so great. What is your explanation?

4. What are the advantages and disadvantages of being included in the Tuttle-Edwards lineage; in the deficient Kallikak lineage?

5. Look up the United States census, and observe the percentage of people classified in the categories given in Table VI. Compare those percentages with the percentages given in this table.

6. Do you think that the human race would improve if the ablest people had most children and the least able had fewest? At present, the opposite is the case; do you see any dangers in that situation for the future of our country?

7. What does war do to the quality of the human stock?

8. What will happen to dull children who are problem children if they are put into very good foster homes? At what age should they be put into these homes?

9. On the bases of the evidence on identical twins reared apart try to formulate a pattern of environmental influences.

10. You are challenged to show that the youngest children in the sixth grade, for example, are there because of nurture and not because of inherent and inherited capacities.

11. What justification for the compulsory-school laws do you find in the evidence given on school attendance and mental and educational abilities?

12. Since the World War, the average amount of education obtained has increased considerably. Assuming that it increases even more, do you believe that the American soldiers in the next war will test higher than they did in 1917 and 1918?

13. For several centuries, the Mexican children and adults have had very inadequate schooling. There is some evidence that probably in the next few years it will be much improved. What changes in the country can you expect as a consequence?

14. Is a high order of ability in mechanics, writing, art, or music inherited?

15. We have seen how, before and during a war, propaganda makes savages out of peace-loving people. Discuss this from the environmental or hereditary point of view, and give comparable examples.

16. Describe an ideal method for improving the people of the world.

17. How should the evidence set forth here influence the teacher in his dealings with his pupils?

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## CHAPTER XI

### PRINCIPLES OF LEARNING

**Directions for Study.**—Learn the meaning of the principles of exercise, readiness, and effect, but do not oversimplify them.

What is the general principle of Gestalt psychology?

Observe that the feeling associated with words influences learning.

The term *free association* is used and is important enough psychologically to warrant its being comprehended.

Dunlap, by means of his three hypotheses, states the possible relationships between response and stimulus. Do not be troubled because two of them are different from our usual notions.

The associated responses show how one of the responses in a situation can be established by association.

What is meant by *primary*, *associate*, and *concomitant* learning?

Three principles of learning that are important in almost every teaching and learning situation have been set forth by Thorndike. To a large extent, the psychology of good teaching consists in controlling the circumstances surrounding the lessons so that those principles will be observed. They embody in a general way the principles of interest, activity, and feeling as they pertain to learning.

**The Principle of Exercise—Use and Disuse.**—This principle is one that we observe when we reread our lessons a number of times in order to learn them. Drill is also based on the principle that repetition fixes the fact to be learned. Children spend much time repeating arithmetic combinations, writing the words of spelling lessons a number of times, and defining and using words in order to establish their meaning. Students participating in a play learn their lines by reading them many times and repeating them when practicing. Repetition and use are so common that they are universally accepted as an effective means of learning. The child learns his piano lessons by playing them over and

over; dance steps by repeating them many times; and the "piece," or poem, by saying it over and over until he can recite it without a mistake.

Lack of practice causes the retention of learned materials to weaken; and, in general, the longer the periods of disuse the greater the loss. Human minds retain what they use. Words that we spell frequently are seldom misspelled, and we do not forget the meaning of words that are used in our writing and conversation. We learn and retain by use and forget through disuse. It is the exception to be able to repeat quotations, define the meaning of words, and recall names if they have been out of our consciousness for many years. Of course, some things have been learned so well that they are hardly ever forgotten even if not often used or recalled; but that is unusual.

Most of the "orations" that we gave on special occasions are forgotten. The pieces and "gems" that were memorized are in large part now gone from our memory. It is customary in some churches to memorize the catechism, parts of the Bible, and some hymns during childhood, but relatively few adults can recall what once was memorized. Should an adult reread material that he once learned by heart, he may even find part of it entirely unfamiliar to him.

Much that people learn is lost because it does not come within their experience again or because too long a time elapses before it recurs. Forgetting, apparently, is largely the result of disuse. Two points can be made in this connection. One is that we should devote most of our learning time and effort to acquiring those facts, skills, and abilities which we will retain because we use them. Secondly, we must recognize the fact that we shall learn much that by its very nature is a temporary acquisition and that will be lost when it has served its purpose. These two approaches seem inconsistent, but both are applicable to the school situation. The first principle should be used for determining what in the content of the school curriculum should be emphasized for permanent acquisition; and the second, for determining what should be taught because of its immediate and temporary usefulness. One experience in learning orations and "pieces" is an example. It was never intended that all the lines should be permanently retained or that subsequent experiences should recall their content. Still, in a broader sense, the learner

may have acquired from the experience an appreciation for good or for poor speeches and developed certain attitudes that govern his attendance at public gatherings. In many instances, certain attitudes and feelings may be acquired that long outlast the memory of the material.

The psychology of use and disuse, which are the two phases of the principle of exercise, run parallel to learning and forgetting. Through use or exercise, we learn and retain; but through disuse or lack of practice, the acquired is forgotten and what is not learned remains unlearned. There are some qualifications to the principle of learning through practice. Learning is not directly proportional to the amount of exercise or practice. In some instances, such as practicing music or memorizing poetry, less practice with more interest results in more learning than perfunctory practice over longer periods of time. Furthermore, in most instances, what is learned is soon forgotten, whereas other materials and experiences are retained much longer, and some seem never to be forgotten and come to mind often. Other factors, especially the emotional ones, influence learning so that the law of exercise cannot be applied quantitatively or mechanically.

**The Principle of Readiness.**—In general, the principle of readiness may be described by saying that when a person feels ready to act or to learn, he does so more effectively and with greater satisfaction than when not ready. If a person feels ready to act and is prevented from doing so, he feels annoyed. A synonymous term for readiness is *mental-set*. A pupil has a mental-set to do his lessons when he is disposed to work at them. Other stimuli do not evoke any response then, and he is interested and therefore willing to concentrate on the tasks toward which his attention is directed. As he continues, his mind-set may weaken; and the time is reached when continuing to act in a direction that earlier was satisfying becomes annoying.

If a student is directed to work on a lesson or to do a task when he has no readiness for it, he will not learn easily. If, however, the lesson proves to be interesting and captures his attention, his learning efficiency will improve and reach a high point. Much of the passive and unprofitable studying done by pupils is due to the fact that they do not have a mind-set for work but merely approach it in a routine and perfunctory way.

A readiness, or mind-set, to master a problem is equivalent to a desire to do it. One of the fundamental duties of a teacher is to develop in children a readiness to learn their lessons. A good assignment, for example, raises questions and cleverly introduces the new materials so that the pupils will be anxious to study them. A teacher who is specific in her assignments and asks interesting questions for the students to solve arouses their curiosity and develops in them a favorable mind-set toward the assignment. On the other hand, the one who perfunctorily takes up one lesson after the other in mechanical order fails to develop the pupils' readiness for their lessons, and they passively approach their assignments as a mere matter of routine.

The mental readiness, set, or interest of pupils is aroused and maintained on a broader scale by using the problem and project methods. Instead of formally taking up a topic, the teacher aims to bring about a learning situation in which the topics will be covered in order to complete a project or solve a problem. If the pupils have a motive and a purpose, they sustain a mind-set for their work, a condition that is equivalent to maintaining interest in it. For example, in learning to write letters, the pupils actually write real letters to real people rather than form letters to hand to the teacher. In some schools, the children exchange letters with boys and girls in other countries. Under such circumstances, children have a mental-set for writing correctly and interestingly. Letter-writing assignments may also be connected with pupils' hobbies. If, for instance, the children are maintaining a flower bed and feel the need of specific information, they will write more earnestly for bulletins and reports from the agricultural bureaus than if they formally prepared letters according to the teacher's assignments.

Similarly, in the history class, there is not likely to be much psychological readiness among students if they are asked to "study the next six pages." If, however, the teacher takes the students to points of historical significance in the vicinity and correlates the lessons with the historical excursion, they are more likely to develop an active readiness to study. Some teachers overlook opportunities to prepare their pupils psychologically for their lessons. In studying Lewis and Clarke's explorations, the pupils and the teacher in a certain city mechanically discussed the contents of the book, even though they were

only a few city blocks away from part of the marked route that they had taken when they passed through the great Northwest. The teacher could have taken the pupils to some of the local points of the route, traced with them the route through their immediate territory, and expanded their study from that point on. Vivid interest is developed by making the problems real and concrete rather than by confining them to the abstract elements of a textbook. When interest in a topic has been generated, the student will work on it with more satisfaction and learn more.

Sometimes events and situations occur that develop a readiness, or mind-set, for events and occurrences that take the pupil's attention away from his lessons. If the teacher is wise, she can in some instances utilize the situations that seem to be distracting. For example, a few years ago an eclipse of the sun occurred on a fall afternoon when school was in session. In a particular school (and there possibly were thousands of others), a teacher had difficulty in teaching because the children were distracted by the approach of the eclipse although they could not go outside and see it. She would not deviate from her daily program of study to give them that opportunity. At the end of the school day, she complained that she had found it so hard to keep the children's attention on their work that she was nearly exhausted.

Because of the curiosity that the children had for the eclipse of the sun, their "minds were not set" for their lessons but for the natural phenomenon that was occurring. The teacher should have taken her pupils outside to view the eclipse and discuss it with them. She had a rich opportunity to utilize the mind-set of her pupils to teach them various facts and principles of geography. To a teacher with originality the experience could also have been the basis for language lessons. Instead she worked against her pupils' natural interest, irritated them, exhausted herself, and lost a fine opportunity to teach effectively.

**The Principle of Effect.**—In general, the law of effect is that learning accompanied by a pleasant or satisfying feeling is strengthened but that learning associated with an unpleasant or unsatisfying feeling is weakened. This principle pertains to the feeling, or emotional state, following the learning experience. When a child finds the correct solution to a question, he feels

pleased about his achievement, and the connections between the stimulus and response are, consequently, strengthened. If the solution was incorrect, the associated feelings of annoyance tend to rub out the connections that had been made, unless, of course, the experience was so painful or embarrassing that the event and the mistake are fixed in the memory. For the most part, however, the connections for the correct responses tend to persist, and those for the incorrect are weakened and eliminated; a feeling of satisfaction fixes a response, whereas a feeling of annoyance tends to destroy it.

Besides the influence that the affective state has on the immediate response, it also controls, to a considerable extent, the interest with which the learner attacks a problem. Pupils avoid problems that have caused them annoyance and approach with interest those whose study has resulted in a feeling of satisfaction.

Success and failure condition the learner to a large degree. Success with a task is generally accompanied by feelings that affect the learning process favorably, but failure is accompanied by the opposite emotional state. The principle of exercise is also involved, because success implies that the proper response has been made and that a repetition of the same or a related response is more likely to occur. On the other hand, failure means that a response has not been made at all or that the inaccurate response that was made will not be likely to persist because of the feeling of dissatisfaction that accompanied it.

The laws of readiness, exercise, and effect are not separate and independent of each other but are mutually interrelated. Readiness and emotional effects influence practice; and, in turn, the emotional effect of practice determines a pupil's readiness in another situation. The pupil who has been unsuccessful is reluctant to resume his lessons, but he who has been successful has a favorable mental set toward his work.

Success and failure influence learning possibly more than any other experience does. Of course, it is also true that the most capable succeed and the least capable fail. Consequently, success stimulates those who are already most capable of learning, and failure further retards those who are least able. Thus, it is desirable to enable everyone to experience success, and it should be possible through careful educational guidance to adjust

the pupils and their work so that they will experience an optimum amount of success.

The relation of success and failure to mental health has been discussed at some length in an earlier chapter. That discussion emphasized the relation of success and failure to the emotional life of the child. The emotions and mental health are very important in themselves, but the emotions incident to success and failure in learning are especially significant. The feeling tone is an important element in readiness, exercise, and effect. A pupil is in a state of readiness to learn when his interest is keyed and his feeling tone is set for the problem. Exercise or practice is most effective when interest in the problem is at a high pitch. Learning is most extensive when the emotions accompanying the completion of a task are satisfying. The emotional, or feeling, element in the learning situation governs the student to a considerable extent, because the intensity of his effort is a function of his interest or feeling. The whole problem of learning is not so simple as this; there are many qualifications, but the principles given are so important that they should be observed.

The emotions of a learner influence his efficiency. We describe the principle of effect in terms of feeling, and there is considerable evidence indicating the effect on learning of praise, blame, reward, punishment, and other factors.

To test one phase of the emotional element in learning, experiments have been conducted to discover the ability of persons to learn words of different emotional tone. For instance, Carter investigated the ability of sixth- and seventh-grade children to learn to associate pleasant, unpleasant, and neutral, or indifferent, words with pictures(1). Pictures were presented one at a time, and a given word associated with each. The purpose of the experiment was to test the ability of the pupils to recall the associated words with the successive presentation of the pictures. There were five trials, and failure to respond and incorrect responses were observed.

Pleasant words are such words as mother, candy, and marry; unpleasant, such words as fright, stink, and kill; and indifferent, or neutral, such words as pen, trade, and number. Three series of eight words of each type—pleasant, unpleasant, and indifferent—were used in the manner described—a word given along with a

picture in successive trials, with the object being to recall the word associated with a specific picture.

In Table X are given the results. The second column shows the rating of the words according to pleasantness on the basis of

TABLE X.—FREQUENCY OF ERRORS IN THE LEARNING OF PLEASANT, UNPLEASANT, AND INDIFFERENT WORDS\*

|                        | Mean<br>P — U<br>rating | Mean<br>associ-<br>ation<br>time | Used in<br>place<br>of cor-<br>rect<br>word | Re-<br>placed<br>by in-<br>correct<br>word | Failure<br>to re-<br>spond | Sum of<br>all<br>errors |
|------------------------|-------------------------|----------------------------------|---------------------------------------------|--------------------------------------------|----------------------------|-------------------------|
| (1)                    | (2)                     | (3)                              | (4)                                         | (5)                                        | (6)                        | (7)                     |
| "Pleasant" words:      |                         |                                  |                                             |                                            |                            |                         |
| Series I, 8 words....  | 1.66                    | 4.50                             | 353                                         | 298                                        | 668                        | 966                     |
| Series II, 8 words...  | 1.86                    | 3.49                             | 167                                         | 144                                        | 516                        | 660                     |
| Series III, 8 words... | 1.72                    | 3.28                             | 100                                         | 119                                        | 455                        | 574                     |
| Average, or totals†    | 1.75                    | 3.76                             | 620                                         | 561                                        | 1,639                      | 2,200                   |
| "Indifferent" words:   |                         |                                  |                                             |                                            |                            |                         |
| Series I, 8 words....  | 2.72                    | 4.52                             | 209                                         | 432                                        | 1,044                      | 1,476                   |
| Series II, 8 words.... | 2.50                    | 3.46                             | 113                                         | 187                                        | 631                        | 818                     |
| Series III, 8 words... | 3.01                    | 3.61                             | 89                                          | 187                                        | 625                        | 812                     |
| Average, or totals..   | 2.74                    | 3.86                             | 411                                         | 806                                        | 2,300                      | 3,106                   |
| "Unpleasant" words:    |                         |                                  |                                             |                                            |                            |                         |
| Series I, 8 words....  | 4.34                    | 5.16                             | 315                                         | 339                                        | 886                        | 1,225                   |
| Series II, 8 words.... | 4.29                    | 4.03                             | 130                                         | 179                                        | 653                        | 832                     |
| Series III, 8 words... | 4.19                    | 3.62                             | 124                                         | 147                                        | 520                        | 667                     |
| Average, or totals..   | 4.27                    | 4.27                             | 569                                         | 665                                        | 2,059                      | 2,724                   |
| Grand total....        | ....                    | ....                             | 1,600                                       | 2,032                                      | 5,998                      | 8,030                   |

\* CARTER, HAROLD D., *Journal of Educational Psychology*, 27: 59.

† The values in columns (2) and (3) are means; those in columns (4), (5), (6), and (7) are sums. The entries in column (7) are the sums of the corresponding entries in columns (5) and (6).

the children's classification of the words into five groups according to degree of pleasantness and unpleasantness. If all the pleasant words had been called most pleasant and placed in group 1, then the average for the pleasant words would have been 1.00; similarly, if the unpleasant words had been classified in group 5 by all the children, the average rating for those words would have been 5. But there was some disagreement, so that the averages were not completely at the extremes 1 and 5 for the pleasant and



unpleasant words, respectively. The neutral, or indifferent, words fell in between the extremes.

The third column should be explained, as it indicates the time taken to respond with words to the words of the experiment when they are given. The method used in testing association time is essentially this: The experimenter tells the subject to respond with the first word that comes to mind when the subject pronounces a word. In this instance, the words pronounced were the words used in the experiment and that had been classified as pleasant, indifferent, and unpleasant. The averages show a slight tendency to respond more quickly to pleasant than to unpleasant words. This is consistent with findings showing that the emotional character of the words, because of their nature of the experience of the subject, affects his reaction time. <sup>f</sup> The evidence of Carter's study suggests that pleasant words are learned more easily than either unpleasant or indifferent ones, but the unpleasant words were learned with fewer errors than were the indifferent. To generalize findings of this kind may lead to oversimplified conclusions. Still, it may be said that the feeling element in learning influences learning. We seem to learn poorest that which has no emotional tone; and of that which evokes a feeling, we learn the pleasant better than we do the unpleasant.

Thus, it is important that subject matter be vitalized and made interesting. A teacher, in turn, who is neutral and indifferent will probably not be so effective as one who is dynamic and teaches with conviction. To promote learning, feeling and emotion should be injected into both the teaching and the learning process. Again we have evidence pointing to the importance of the character and personality of the teacher.

**The Gestalt Principle of Learning.**—According to the Gestalt theory, or principle, psychology has overemphasized the individual elements in the learning situation and overemphasized limited stimuli and *S-R*, or bonds. It is wrong according to the Gestaltists to think of learning and memory as being determined by the number of connections between individual stimuli and responses.

Instead, learning is determined by the pattern of the stimuli, or the configuration. The interrelationship of the elements, how they shape up as a whole, is what causes the character of the

perceptual field. The perceptual field will be shifted or changed according to their arrangement or new pattern of stimuli. The changes in pattern result in new learning. Consequently, there can be a change in the field or pattern of stimuli that results in sensing the idea or acquiring the solution quick as a flash. This is called *insight*. A learner may, for example, be working a problem in arithmetic or a puzzle and make no progress until the solution comes all at once, so to speak. According to the Gestaltists, this is learning by insight.

That it is not the absolute individual stimulus but the inter-relationship of stimuli or the integrated pattern was illustrated in an experiment involving chickens that were trained to peck food from a paper a darker shade of gray than the paper next to it. Then the papers were changed so the paper that had been the darker became the lighter, because the new paper was of a still darker shade.

Then the chickens pecked from the darker paper instead of the one from which they had pecked before. The relative feature of the situation—that of being darker—was what determined the response, and not the absolute stimulus.

The Gestaltists, in their theories of learning and experimentation, emphasize meaning, organization, integration, and pattern of stimuli. The whole of the situation rather than its separate parts determine the perceptions of the learner. Gestalt psychologists have caused psychologists and educators to conceive of the problem of learning in more comprehensive terms and units.

### REPETITION AND LEARNING

- ( Ordinarily, it is held that the extent of learning is in proportion to frequency of repetitions. Consistent with the principle of repetition is the statement that no exception should be allowed to occur. According to some pedagogues, for example, only "It is I," should be repeated and not the more usual expression. It is argued that the wrong forms should not be repeated, even for purposes of correction. This point of view is not entirely sound, because repetition alone does not fix a response. A contrary theory holds that the best way to eliminate errors is to repeat them(2). According to this theory, the way to eliminate a grammatical error is to repeat it consciously; the way to learn

to spell a word correctly is to repeat the incorrect spelling; and the way to prevent common slips in typing is to type the incorrect word.

In a discussion of learning, Dunlap presents three theories. One of them has been discussed without being formally stated, but all three of them will be given together to give us a clearer perspective of the effects that the occurrence of a response may have on the likelihood of its occurring again. Dunlap uses the Greek letters alpha, beta, and gamma to designate his three hypotheses. They are as follows:<sup>1</sup>

1. Alpha hypothesis: The occurrence of a response increases the probability that it will occur again when there is the same stimulus.

2. Beta hypothesis: The occurrence of a response lessens the probability that the stimulus which produced the response will do so again.

3. Gamma hypothesis: The occurrence of a response has no effect on the probability of the occurrence of the response.

The alpha hypothesis is the more conventional one and is generally considered as explaining learning by repetition. The beta and gamma hypotheses, however, indicate that an experience or response either diminishes the likelihood of the response's occurring again or has no effect at all. According to these theories, there are three effects of a stimulus and response situation—the positive, the negative, and the neutral. On the basis of these, a wider point of view is taken toward the effects of repetition and practice. In them we can see the explanation for the responses of children, some of which seem to contradict our more conventional principles of practice.

**The Beta Theory.**—Because this theory has been defined, the following discussion of it will be devoted to its application. Dunlap reports several experiments that he conducted according to this theory. They included attempts to cure stammering, fingernail biting, thumb sucking, and several other habits. In general, the procedure consisted of practicing or repeating the wrong habit. This is called *negative practice*.

There are certain attitudes that the learner should have in order that the negative practice may be effective. He must be

<sup>1</sup> DUNLAP, KNIGHT: *Habits—Their Making and Unmaking*, p. 78, Liveright Publishing Corporation, New York, 1932.

aware of the bad effects of the habit, understand the advantages of breaking the habit, have a desire to break the habit, and engage in practicing the bad habit with the earnest purpose of breaking it. The points of view and general attitude of the learner must be as indicated, or else the procedure will not be effective.

Illustration may be given of the theory as it was applied to stammerers. During the practice periods, they stammered voluntarily, simulating as nearly as possible their involuntary stammering. Occasionally, a stammerer would attempt to speak words without stammering. If he could do so successfully, he would discontinue the negative practice. If he was unsuccessful, he would resume immediately the negative practice, or voluntary stammering. Attempts were made later again to speak without stammering; if successful, the negative practice was abandoned.

Dunlap reports that after three months some adolescents were completely cured. He also reports good results in breaking the habits of fingernail biting and thumb sucking. His results are encouraging enough to warrant teachers' experimenting with the method. No one, however, should proceed without carefully planning the procedure and being grounded in the psychology involved.

A teacher, for example, might experiment with children who have trouble with their *th*'s. In some areas, there are many children with foreign-born parents who pronounce their *th*'s as *d*'s or *t*'s, in such words as *rather*, *though*, *those*, and *moth*. A group of such children could be classified for periodic negative practice. In trying this method, it is necessary for the teacher to give the children confidence that they can break their habit of pronouncing the *th*'s incorrectly and tell them that they should not practice listlessly but concentrate on the negative practice. An ingenious teacher can find many specific situations in arithmetic, reading, language, and other school subjects as well as in the field of habits and other personality problems where he might profitably try negative practice.

#### LEARNING THROUGH THE ASSOCIATED RESPONSE

Much that we learn is learned through connection with certain facts and situations. Many of our feelings and attitudes are acquired through associations. A given color may be favored

because our experiences with that color have been pleasant. Thus, a young woman may like blue because her party dresses and traveling suits have been blue and, therefore, are associated with a festive mood. Black may not be so popular because it is associated with old age and funerals. An individual may have learned to regard people with certain facial features with suspicion because somebody with similar features once tricked him. Words are learned by associating them with the thing that the words describe or name. In situations involving facts and attitudes, we acquire them through association.

The associated response can be illustrated with the following diagram:

$$\begin{array}{l} S_1 \rightarrow R_1 \\ S_2 \rightarrow R_2 \\ S_1 + S_2 \rightarrow R_2 \\ S_1 \rightarrow R_2 \end{array}$$

$S_1$  represents stimulus one, and  $R_1$  represents response one.  $S_2$  represents stimulus two, and  $R_2$  represents response two. According to this diagram,  $S_1$  brings out  $R_1$ ;  $S_2$  evokes  $R_2$ ; and, because  $S_1$  and  $S_2$  occur together,  $S_1$  causes  $R_2$ .

We may illustrate by showing how a child was conditioned to fear a harmless snake. The presence of the snake evoked a manipulative response on the part of the child who played with it. The mother saw the child with the snake and screamed frightfully. The baby was thereby conditioned to fear the snake.

The following diagram shows graphically how the child learned to fear snakes.

$$\begin{array}{ll} S_1 \text{ (sight of the snake by the child)} \dots\dots R_1 \text{ (playing with it)} \\ S_2 \text{ (sight of the snake by the mother)} \dots\dots R_2 \text{ (screams because of fear)} \\ S_1 \text{ (child sees snake)} \dots\dots\dots R_2 \text{ (fear of snake)} \end{array}$$

In this instance, the response of the mother was associated with the stimulus and response of the child. Therefore, when the child sees a snake  $S_1$ , he will respond with fear, or  $R_2$ .

The teacher as an important factor conditions the attitude of her pupils toward the subjects and situations that arise in the room. If the teacher has a strong personality and therefore is appreciated by her pupils, she will, by the principle of associated

response, condition her pupils to be interested in their school work. She has their good will, and consequently she is associated favorably with their responses in the situations in which she is a factor. The presence of the teacher evokes a favorable response, and therefore the school work for which she is responsible will evoke a more earnest response also. Conversely, if the pupils are antagonistic toward their teacher, they are also likely to be conditioned to take the same attitude toward most situations in her room.

### PRIMARY, ASSOCIATE, AND CONCOMITANT LEARNING

Philosophers in education have emphasized the fact that students learn not only the immediate facts that they are studying or the tasks on which they are working but also the related, or associated, ones. In addition, certain concomitants are developed that may be very important. The primary learning consists of the facts, principles, theories, etc., that are the main core of the lessons in particular and the curriculum in general. The associated learning consists of the facts and other more objective materials that are learned because they are related to the primary and are logically brought into the lesson. The concomitants consist of the attitudes, ideals, and appreciations that the student acquires because of his school experience.

These three phases of learning may be illustrated by using a course in woodwork or manual training as an example. We may assume that one of the primary objects of the course is to train the students to use tools and be able to build and construct with wood. That would be the primary learning. In addition to acquiring those skills and abilities, some associated learning will take place. It may consist of learning to read blueprints; of knowledge about different kinds of woods, their cost and source of supply. These facts and others can logically arise in connection with the woodwork itself. Out of the experiences in this course, certain more or less intangible results or concomitants may emerge. Attitudes of appreciation may develop for a high order of craftsmanship. Probably the pupils may acquire a sense of appreciation for workmen, especially carpenters and furniture makers. They may learn that some kinds of wood are scarce and that our supply of practically all lumber is rapidly decreasing. That would be an associate learning, but out of it

might develop the ideal of conservation and the attitude that we must harvest our trees judiciously.

**Concomitant Learning.**—The ideals, attitudes, and appreciations acquired in a situation govern behavior in many instances to a larger extent than do the facts, skills, and principles acquired. The concomitants are an outgrowth of facts and skills, but the former often long outlive the latter. We can illustrate by considering the effect that certain courses may have on the behavior of the students who took them. Let us assume that some citizens in a community who took courses in bacteriology and chemistry are faced with the problems of voting for or against a sewage system or other measures of sanitation. They most likely have forgotten most of their bacteriology and chemistry, but certain attitudes and appreciations engendered by the study of those subjects are almost certain to cause them to favor improved sanitation. Long after the facts in chemistry and bacteriology that are found in courses and examinations have been forgotten, certain attitudes and appreciations will remain to influence behavior.

Concomitants, or the intangibles acquired, are of such importance that psychologists and educators might well be concerned as much about their psychology as about the primary, or core, learning. In a country of free public education, the attitudes and ideals that the pupils acquire matter a good deal. We spend millions of dollars and the lives of thousands of teachers and other employees educating our children, youth, and adults. In particular, it matters whether those educated in our schools at public expense leave them with an individualistic attitude and an ambition to exploit their fellow man or whether their attitude is a more cooperative one and expresses itself in social consciousness. Furthermore, the ideals, broad sympathies, and scientific attitudes that are learned contribute much to happy and fruitful living.

### SUMMARY

Three well-known principles of learning are those of exercise, readiness, and effect. Their corresponding equivalents are use and disuse, mental-set, and state of feeling. There are qualifications to these principles, especially the first one, and so they are not so simple as they may appear. It has been discovered that

pleasant words are learned more easily than unpleasant words and neutral ones most poorly of all, thus indicating the importance of the affective elements in learning.

According to Gestalt psychologists, we learn in patterns, or wholes. The stimuli are not independent but are effective in terms of each other.

The most stimulating of Dunlap's three hypotheses is beta, which is to the effect that a response to a stimulus lessens the probability of that response's being made again to a given stimulus. It is contrary to the usual psychological principles but may help to explain some of the failure of the principles of exercise.

According to the principle of the associated response, a response in a situation that is accompanied by another stimulus may become the response to the other situation. Many of one's reactions are learned because of association.

Primary learning refers to the facts, information, and knowledge that are the immediate objectives of the learner; associate learning, to the facts and information learned by the study of related problems growing out of the primary; and concomitant learning, to those feelings and attitudes which have developed because of the experiences in the primary and associate situations.

### Problems and Exercises

1. After school, the boy writes one hundred times "I have gone home," because he expressed himself incorrectly; but in a note to his teacher, which, in her absence, he has put with his paper on her desk, he states, "I have went home." Explain the psychological principles involved.

2. Explain the psychological principle involved in the statement "Nothing succeeds like success."

3. Give your point of view on the practice of an algebra teacher who, when the lesson was very hard, would warn the pupils, "This lesson is going to be hard to get!"

4. Describe some situations in which the principles of exercise, readiness, and effect are illustrated.

5. On the bases of our knowledge of learning the pleasant, unpleasant, and neutral, why is it important that instructors be not colorless, neutral individuals but interesting personalities?

6. Name some situations in which the beta hypothesis might profitably be tried out.



7. While a little child reaches for a cookie, the observing mother makes a loud noise by hitting a pan. The child withdraws his hand. When he sees a cookie another time, he reaches only feebly or not at all.

$S_1$  (cookie).....  $R_1$  (reaches for it)

$S_2$  (loud sound).....  $R_2$  (withdraws hand)

$S_1$  (cookie)..... What is the response likely to be?

8. Certain ideas and prejudices that we have may result from certain associations that these ideas may have. Will you illustrate?

9. A child in his geography class is studying the country of Denmark. He learns about the climate, resources, and industries. Incidentally, he becomes interested in their folk schools and reads about them. He also studies Danish history; and as a result of his studying, he develops a great respect for the Danish people. Designate the various types of learning illustrated in this situation.

10. Give some illustrations of primary, associate, and concomitant learning.

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## CHAPTER XII

### THE COURSE OF GROWTH AND DEVELOPMENT THROUGH LEARNING

**Directions for Study.**—The discussion in this chapter centers largely on growth and development over a comparatively long period of time. Now and then, it concentrates on the course of learning over a shorter period; the intent is to direct the reader to think in terms of both the long and the short period and the course of development through learning over those periods.

The learning and performing ability of persons differ from day to day. Learn the reasons for this daily fluctuation.

For children, learning over a period of several years cannot be separated from growth, so the two are considered together. Explain.

Study the learning curves carefully. On all of them the base line beginning with the left and going to the right indicates an increase in practice.

Note also the difference between increase of skill and decrease in the number of errors.

Be able to describe curves in which the learning is slow at the beginning, rapid at the beginning. Be able to explain such terms as *convex*, *concave*, and *plateau*.

Note the explanation for the presence of plateaus and how to avoid them.

There are both practical and physiological limits of learning. Be able to differentiate them.

From birth to adulthood, probably the best ally of learning is growth. The studies with twins are helpful in this connection, and reference should be made also to the mental-growth curve. Study these facts.

The adult ages are much more effective for learning than we formerly thought. In fact, for learning subject matter, the first half of adult life is probably the best. Observe carefully the discussion of the adult ages and learning ability.

Curves representing the development and acquisitions of learners follow interesting courses. Try to visualize, for instance, a curve depicting the acquisition of vocabulary from birth to old age, or throughout the span of life. Similarly, what is the growth in various sensorimotor abilities some of which we acquire incidentally and some through special effort and practice? Furthermore, what is the course of learning for children as a whole and individually from kindergarten up through the eighth grade, high school, and college? At present, there is increased interest in the direction that learning takes throughout the adult years from maturity to old age. Curves representing growth and development may represent a composite of many abilities, or they may represent the growth of more specific abilities such as reading, arithmetic, language, and history.

This introduction to the topic of growth through learning has stressed development over a long period of time. Important also is the nature of development over a shorter period. For example, if individuals practice typewriting for several months, the curves depicting their increase in speed and accuracy would show definite trends. Likewise, in an attempt by persons to learn a language, to develop ability in tennis or golf, to acquire a trade, to play the piano, to give a mental examination, and to gain proficiency in bridge, the course of learning could be depicted and described graphically. The learners would go through various characteristic experiences. In the beginning, the progress might vary. Initial learning would be slow in some instances and more rapid in others. In the course of nearly all learning, a time is reached when no progress is made for a time, and at this period the learner seems to be on a dead level. Generally, he improves and emerges from the period of no growth to reach eventually a point where no matter how hard he tries he can improve no further.

If a chart is made of day-by-day learning and performance, great variations in efficiency will be found. On one day, a pupil will be twice as efficient as on another; problems that are difficult at one time will be much easier at another. Fluctuations in individual abilities are characteristic of all and cannot be avoided. Baseball players bat, field, and pitch better on one day than another; lecturers express themselves better at different times; workers vary in their efficiency from day to day; and,

in general, pupils learn more readily on some occasions than on others.

Variation in achievement is the rule and cannot be avoided because so many factors and conditions influence performance and cause these variations. To a considerable degree, they are physiological or internal, but there are also factors external to the person himself. Some of the personal, or internal, factors are capacity, fatigue, emotional conditions, and health; whereas the external factors are difficulty of material to be learned, incentives and motives, weather conditions, noise, and other distractions. The combinations of these factors vary from day to day and influence achievement correspondingly. When the combination is most favorable, efficiency is highest; when it is least favorable, efficiency is lowest. Each individual has an average level of performance that is characteristic of his particular efficiency. There are fluctuations about this average influenced by the factors that have been mentioned.

### THE LEARNING CURVE

There really is no single learning curve. So many factors influence the direction taken by learning that there are many learning curves. Learning curves vary from individual to individual, from school subject to school subject, according to whether the learning period is long or short, the materials are hard or easy, and also the manner of drawing them or their arrangement. Even though there is great variation, still there are certain characteristics of the course of learning that should be discussed as general principles. In a general way, the curve of learning may be divided into three sections: the beginning, the end, and the portion between the beginning and end. This classification is oversimplified, of course, but is useful for setting forth some of the principles pertaining to the development of skills and abilities. In order to have something concrete to describe, we shall set forth two simple learning curves, Figs. 12 and 13. The initial progress according to Fig. 12 is slow. Apparently, little is gained at the beginning. It is typical of the progress of a child in learning to read or an adult in learning a difficult foreign language. There is a period of weeks and sometimes months in which no perceptible progress is being made. A few words are

being learned, but little development of the ability to read from the printed page is apparent.

Following a period of no apparent growth, there is a rise in the curve representing a rapid measurable increase in ability. This growth occurs for a period of time and is represented by the more nearly vertical part of the curve. After a time, however, the improvement slows down and then stops. The period of greatly reduced gain following rapid learning is represented in Fig. 12 by the upper part of the curve.

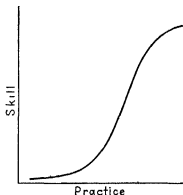


FIG. 12.—Concave-convex curve.

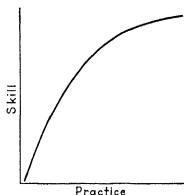


FIG. 13.—Convex curve.

This type of curve represents the growth of various abilities. The growth of a child's reading ability is depicted in a general way by Fig. 12. After the initial phase of no apparent development, there is a rapid rise of ability which reaches at some time in the teens a period of little or no improvement. Ability remains quite constant thereafter. Much of human learning and growth takes the course illustrated in Fig. 12. For example, the curve depicting the growth in the walking ability of infants is like that. For nearly a year, there is apparently little increase in walking ability, although of course the development of physical structure involved in walking is taking place. After a child begins to walk, his ability increases rapidly; but a time is reached when there is little improvement. Similarly with the development of vocabulary. There is no apparent learning of words until a child is about twelve months of age. Then their acquisition increases rapidly until maturity is reached, when very little,

if any, further growth of vocabulary occurs. The part of the curve representing the period of no growth or development is flat, and therefore that period is called a *plateau*.

In learning almost any material that is difficult for the learner, the initial progress is extremely slow. Apparently, it takes a long time to get started. Slow initial improvement characterizes the learning of hard problems in mathematics, an unfamiliar language, learning to play the piano, or the acquisition of any skill and ability that seems to defy for a time the attempt to acquire it.

Examination of the lower half of the curve reveals that part as being concave. The upper half is convex. A curve is concave when the rate of learning is increasing. It is a curve in which a period of more rapid learning follows a period of slow improvement. Obviously, a learning curve cannot be concave if the entire course of learning is depicted, as it is impossible for the rate of learning to increase indefinitely. It must slow down in approaching a period of no improvement and then ultimately reach that period. No one can continue to improve indefinitely in every given function. A person can take up a new subject or attempt to acquire a new skill, and he will manifest improvement, but ultimately he will reach a plateau from which he cannot emerge to a higher level. A pupil reaches at some time the limit of his ability to compute arithmetically; the typist reaches a point where, no matter how hard he tries, he cannot type more rapidly or more accurately; the musician reaches a point where his playing does not improve—he can learn new pieces, but the quality of his performance does not become better. Similarly with all our learning. There are limits beyond which we cannot go, but it must be remembered that we seldom reach them; and in many fields, our learning has not even developed past the initial stages.

The curve of learning depicted by Fig. 12 is concave-convex; the lower half is concave; and the upper half is convex. This curve is general, but it does depict the direction taken by much learning. There are, of course, many individual variations. Fluctuations characterize individual curves, and only summary or average curves are free from irregularities. Then, also, plateaus occur for short periods which are not shown by a curve

that depicts the progress of learning over a long period. The course of curves depicting the acquisition of skills over shorter periods of time will be discussed later.

The curve can be reversed if the mode of representation is changed. For example, if instead of showing the amount acquired, the number of errors is recorded according to successive practice or according to time, the curve will start high and go down as the number of errors decreases. Figure 14 is this type of curve; it shows improvement by its descent.

**Rapid Initial Start.**—Figure 13 represents a learning curve in which initial progress is rapid. Improvement is fast from the beginning and continues for a time, after which it slows down at the level where no further improvement occurs. The curve, as given, is a convex one, representing rapid initial learning which slows down with time. A learning curve is generally convex when the learner brings to the problem a capacity and initial ability that enables him to progress rapidly from the start. In such instances, learning does not begin at the zero point, and the slow initial phases have probably been overcome by the previous acquisition of abilities. When this is the case, learning appears to increase rapidly from the beginning, whereas in reality the slow initial phases have been overcome by previous learning.

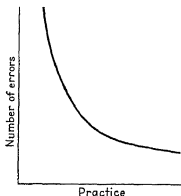


FIG. 14.—Decline in errors with practice.

When learning to skate, for example, we bring to the problem of acquiring that skill all the sensorimotor abilities that we have acquired in learning to walk and in maintaining our equilibrium. Also, in learning to play quoits, a person begins with tossing skills that he has acquired in other games; consequently, learning is more rapid than it otherwise would be. Similarly, when a person starts to learn algebra after having studied arithmetic a number of years, when he approaches geography and history after having had several years of reading experience, initial

progress is more rapid because of allied experiences. In general, we begin few tasks without some preparation that will cause rapid initial learning.

In learning material that is intrinsically difficult or in learning material that is difficult because it is unfamiliar, the curve depicting progress of learning will not show a rapid initial rise. If one is trying to solve difficult puzzles, there is little growth at first, but the solution often comes rapidly after a period of no apparent progress. Likewise, in attacking difficult problems in arithmetic and algebra, the progress is very slow at first, but a time usually arrives when one seems to get an insight into their solution, and then progress is rapid. The curve depicting such progress in learning is concave until it tends to flatten out and adds a convex portion, thus becoming concave-convex. This curve is different from the one in which the initial progress is rapid, in that the latter does not have the concave portion and is only convex. Reference to Figs. 12 and 13 may help clarify these various concepts that have been set forth.

Another explanation for the rapid initial rise in the curve is found in the fact that the tasks or problems are novel when first attacked. Greater progress is made until interest wears off. Not always, however, is the learner as interested in the beginning as he becomes later when he increases his efficiency. In the case of the acquisition of many of our abilities and habits, it is first necessary to go through much discouraging work before the development of facility stimulates us to work with avidity.

**Plateaus.**—Periods of no visible progress are called *plateaus*. The portion of a learning curve that depicts a plateau is the flat portion. The flat parts of the learning curves between their end portions are considered the plateaus, although the initial portion representing very little increase and the final portion, if showing no growth, are also plateaus. During the period of the plateau, there is no apparent growth or improvement in learning. When the pupil does not improve in his reading, when the piano student's playing seems arrested, when the gymnast is not bettering his performance, and when the speech student shows no improvement, we have examples of plateaus. They generally last during the acquirement of abilities for a period of days, weeks, and months, as is implied by these examples; but plateaus also occur in the development of abilities throughout a substantial portion



of even the whole of a lifetime. There are periods between initial development and the ultimate limit when the course of learning remains relatively flat.

In this discussion, we shall not consider as a plateau the end portion of the learning curve as it probably represents the limit of improvement for any particular person. The limit of improvement will be discussed separately. The explanation for periods of no apparent improvement between the initial and end phases of the learning will now be discussed.

A learner may be on a plateau because of fatigue or boredom. Boredom is probably the more important factor. If the learner loses interest, becomes perfunctory, or falls into a mechanical routine, he is apt to be on a plateau. Sometimes there are periods of a month or more when a pupil makes no progress in his subjects. He appears bored and uninterested; but after a period of no gain, something seems to happen that causes a spurt in his achievement to take him off the plateau. These plateaus, or periods of no gain, almost always occur unpredictably, and their termination is largely unpredictable also.

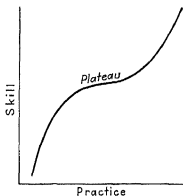


FIG. 15.—Convex-concave curve emphasizing a plateau.

Another explanation of the plateau is that during its period the learner is acquiring a higher form of response. He is emerging from a simpler and less effective form of learning and response to one that is more complex and efficient. In reading, for example, the pupil is learning to combine the phonetic parts into words or the words into phrases. There will be an upward swing from the plateau when the pupil has succeeded in making the larger combinations. In arithmetic, the ability to add shows improvement when the learner is able to add several numbers at a time rather than one number to another. Multiplication may show improvement when the teacher helps the pupils with their specific difficulties in carrying. A person who may have used the simple one-finger "hunt-and-peck" system of typewriting

may experience a plateau in trying to learn the touch system, which involves all fingers and requires that the typist do not look at the keys. No improvement may be in evidence at first, and performance may even be poorer for awhile; but after a period of practice, skill will reach a higher level. Also, a person may be on a plateau in the levels of his thinking until he can generalize his facts into principles and, in turn, applies the principles to specific situations. Formerly, he treated his facts as more or less isolated and did not integrate them into logical conceptual patterns. Thus, a learner may be on a plateau while he is making a transition from a lower to higher level of performance.

We have been speaking of levels of performance varying in complexity from the simple to the complex. This is often referred to as the *hierarchical organization*. The simpler emerges into the more complex, which, in turn, becomes reorganized into still more complex and effective behavior. Hierarchical organization is apparent in most logical arrangement of subject matter, as in mathematics, which ranges from the simplest addition to the most complicated mathematical equations of an Einstein. The simple is progressively organized into the more complex until the organization becomes so complex that only a few can comprehend it. Learners vary in the level beyond which they can go. Some with little capacity go hardly beyond the simplest levels; most reach the average; and a few are capable of the highest reaches. According to the theory of hierarchy of performance, the plateau is a period when the learners are making the adjustments for emerging into a more efficient and complex type of performance.

In the development in any field of learning or the acquisition of skill, a place in the curve will be reached when the complexity of knowledge or skill causes a considerable slowing down. This is represented by the flattening out of the curve.

Partly related to this factor of increasing complexity is the amount of improvement that remains. At the beginning, all is in front, so to speak; but as the learner progresses, the possible amount of material to be learned decreases. Complexity usually increases also, but the percentage to be learned diminishes, and consequently the rate of growth slows down. The flattening of the curve often represents the approach of a point when a practical limit is being reached.

In a discussion of plateaus, it is often asked if they can be avoided. Is there a method of preventing their occurrence? They seem to represent a loss, and it would be desirable to avoid them so that learning may progress steadily. There probably is no way of entirely preventing plateaus, but they may be lessened in number and shortened in duration if the learner is highly motivated and his interest well maintained. It is impossible to maintain interest continuously at a very high pitch; even if it were, it is doubtful that all periods of no improvement could be prevented.

The best recommendation that can be made for preventing plateaus is to cease practice when the learner is failing to show any betterment in his performance. In short, take a few days off or turn to a different task. When a person seems stale or unable to make progress and his efforts in certain directions lead to naught, he should cease trying and utilize his time doing something else. He is on a plateau and will probably make as much progress in the end if he abandons the work for a time, because he may progress from the start when he comes back to it.

In an experiment with ball tossing, Miller<sup>1</sup> avoided the plateau for some of his subjects by having them discontinue practice for a time when it was apparent that they were not showing any improvement.<sup>2</sup> Those who continued their practice without interruption and worked through their plateau, so to speak, made no more progress than did those who had less practice as a result of stopping it temporarily when they entered upon a period of no improvement. If it is a fact that taking time out avoids the plateau, then it would seem that the plateau is not necessary for effecting the reorganization of the simpler processes into a more complex response. During the plateau, certain inhibitory factors or poor techniques probably drop out, and time may be the factor that is responsible rather than practice.

In a general and empirical way, we know that we progress most if we take time out from our work. During the year, we arrange to have vacations so that we can return to it more efficient than

<sup>1</sup> Unpublished research.

<sup>2</sup> The object of the learner is to keep tossing and catching balls, generally two of them. When he misses the ball or has to catch both of them, or if one ball is not in the air, an error is counted. The number of tosses between errors gives the score.

before. People avoid falling into a dead level of achievement by taking on hobbies; obtaining a year's leave of absence from their work; or, in general, getting into a different environment and developing new interests. Empirically, we know that efficiency and interest in one's work are maintained by absenting oneself from it for shorter or longer periods. Similarly, when viewed more narrowly in terms of acquiring skills and abilities over a shorter time, it is consistent with known facts that plateaus can be avoided if the learner discontinues practice when a period of no improvement is reached.

**Limits of Improvement.**—In acquiring any skill or ability, a person reaches a limit beyond which he cannot go no matter how hard he tries. In the growth of an individual's reading ability, a time is reached when ability to read rapidly and understandingly does not improve. Also, there is a limit to the speed with which a pupil can multiply, add, subtract, and divide; write words and numbers; operate a typewriter; sew with a needle; plane a board; or draw a line. In these activities, a limit of improvement is soon reached.

When the simpler skills are involved, it is easy to comprehend the limits of learning. We realize that the maximum scores obtained by individual children and adults in the simpler arithmetical processes are reached after a comparatively short time. It is apparent that in typing, tennis, golf, and other sensorimotor activities, a limit of improvement is reached. This is called the *physiological limit*. There is a limit in the facility with which the eyes can move in the case of reading, the fingers in typewriting, the legs in running, and the speech organs in speaking. In the learning of skills, limits of improvement are more apparent than in the acquisition of the more abstract powers.

When the more abstract materials are involved, it is not so easy to realize the limits of improvement. It would seem possible for all people to continue throughout life acquiring more words, increasing their fund of historical and geographical knowledge, and improving their abilities in mathematics. Still, an equilibrium is reached when the amount acquired equals the amount forgotten or lost, and then the limit of improvement has been reached.

Limits of learning involving both sensorimotor and abstract materials vary from person to person. Some have very high

limits; most have moderate or average limits; and some have limits that are very low. These limits of learning capacity may be described as the altitudes of each person's power. Even though each individual has an altitude or limit, he very seldom reaches it. Each person in practice reaches a limit below his actual, or physiological, one. This may be called the *practical limit*. The distance from the practical to the theoretical varies from person to person and also according to the kind of material learned. Some pupils may expend a maximum effort and approach their theoretical limit more closely than others who try less hard. The *theoretical*, or *physiological*, *limit* is the limit reached when a person is highly motivated and expends all the energy that he possesses in learning the problems or tasks that he is trying to master. Children preparing for an important spelling contest with intensive drills and practices are probably learning at their maximum limits, whereas the boy who is routinely preparing his lessons is far from his limit. When students cram for their examinations, their learning is at their maximum; but in the end, the amount that they have learned does not approach the limit of their capacity.

Thus, it is well to differentiate between learning, or performance, at maximum for a short period and the reaching of one's limit in any given activity or subject. A child may for the day be doing his very best in silent reading but not have reached the extreme limit of speed and comprehension that he is potentially able to reach. Similarly in writing, woodwork, history, art, or any other activity or field that may be mentioned. It is rare that anyone is learning according to his full potentialities in more than a few instances, such as in music, spelling, games and sports, or other subjects and activities when the motivation or competition is very strong.

Furthermore, it is doubtful that a child or adult should be keyed up to a point where he reaches his limit of learning and performance. In limited areas, one may devote his maximum efforts to learning. A musician's, actress's, surgeon's, golf player's, lecturer's specialized performance should reflect a maximum of effort and learning, but a pupil or teacher should not be expected to reach his potential limits in all that he does. The former must be at his limits for shorter periods, and even he often performs at a level below his maximum. On the other hand the pupil

and teacher continue over a longer period involving more varied activities and cannot be keyed to maximum learning at all times. Their practical limit should be as high as possible consistent with good living. If pupils and teachers worked to maintain a learning level equal to their potential limits, they would develop nervousness and ill health. Learning should be maintained at an optimum level consistent with good emotional adjustment. Many pupils and teachers are at a level much below the best practical one. These should be motivated to greater efficiency. Others strain themselves by attempting too much learning; they should adjust to a more practical limit.

#### AGE, MATURITY, AND LEARNING ABILITY

In dealing with the topic of age and maturity in relation to learning, it is well to discuss two phases. The first is age in relation to learning up to the period when mental and physical maturity is reached; the second pertains to learning after that stage of development. Age is a much more important factor in learning during childhood than it is during adulthood. A few years in the age of a child make a tremendous difference; but in the case of an adult, it matters little.

**Age and Learning up to the Period of Mental Maturity.**—Figure 7 on page 154 depicts the general nature of mental growth. The precise age when mental growth stops because of the cessation of maturational processes is still a matter of controversy. Some psychologists believe that mental maturity is reached at the age of thirteen and fourteen, whereas a few think that they have discovered growth extending through the late teens and into the early twenties. The experimental evidence indicates that the rate of mental growth after fifteen or sixteen is comparatively slow. The period when the annual increments of mental growth are greatest merely from growing older are the preschool and elementary-school periods of life. During high-school years, growth through maturation is much slower, and it may be considered as reaching its limit during the college years.

During the preschool and elementary-school years, however, a child matures greatly during a single year. Though at six he finds some tasks too difficult, at seven he can do them, and at eight he finds them easy. The type of exercises that are included in intelligence tests may be graded so that only 35 per cent of

five-year-olds will pass them; but as many as 70 per cent of six-year-olds will pass the same tests. The percentage of successive age groups who pass tests of their age levels increases rapidly from age to age during the earlier years, because growth through maturation is most rapid before the teens are reached. The increase in the percentage of boys and girls in the teens who pass test items is much less from age to age than that of younger children.

The factor of age is, consequently, very important educationally. If a child cannot learn to read at the age of six, he can probably learn at seven or eight, unless his rate of mental growth is extremely slow. If his mental level is not high enough at the chronological age of seven or eight, it may be adequate at a higher age. In the case of some children whose I.Q., or rate of mental growth, is very low, a level adequate for learning to read is never reached. The mental level, or M.A., of a pupil indicates in a general way what he is able to learn. The C.A. of children is important in the sense that with an increase in age, an increase takes place in mental capacity. The amount of increase is indicated by the I.Q. A child with an I.Q. of 150 grows a year and a half mentally in a chronological year and consequently has capacity for doing a number of tasks at the end of a calendar year that he could not do at the beginning. A child with an I.Q. of 75 will increase only .75 of a mental year, or one-half as much as the child with an I.Q. of 150. The duller child has not improved much from one birthday to the next and, therefore, has not increased his mental power enough to be able to learn much more readily than the year before. At the end of two, three, and four years, however, the total amount of mental increment is enough to be important educationally. Widespread recognition of the differences in rate of development would bring about the organization of a separate educational program more suited to the capacities of these slower children.

**Growth, Training, and Ability.**—An approach to the problem of testing the importance of maturation in human development was made by Gesell and Thompson and also by Strayer (1, 2). They used a pair of young identical twins in order to examine the effect of increasing age, or maturation, on physical and mental abilities. Because the twins were identical, one could be used as a control against the other. If one were trained differently

from the other, any observable differences in their behavior and abilities could be ascribed to differences in training. In the experiments referred to, attempts were made to determine the effect of maturity on motor and language abilities.

In the first experiment, the twins were about a year old, and they were tested for their ability to climb five steps. Twin T was given more training and practice than the other, designated as twin C, the letter symbolizing the word *control*. Twin T was given six weeks of training in climbing stairs. The training began when she was forty-six weeks old and ended when she was fifty-two weeks old. Twin C was given only two weeks of training but began at the age of fifty-three weeks and therefore ended at the age of fifty-five weeks. It is important to note that twin C was seven weeks older when she began her training than twin T had been. Twin C was given four weeks less training but was three weeks older when the training period ended. In short, twin T was given more training, but twin C was older. The investigators wanted to discover whether or not more training at a younger age will develop more motor ability of the kind needed in climbing stairs than less training at a greater age; in other words, they were interested in the question of training versus maturity.

The results indicate that being older outweighs the advantage of longer training. Gesell and Thompson summarize their results as follows: "The climbing performance of twin C at fifty-five weeks was far superior to the climbing performance of twin T at fifty-two weeks, even though twin T had been trained seven weeks earlier and three times as long. The maturity advantage of three weeks of age must account for this superiority."

The comparative effect of maturity and training on the grasping and manipulative ability of the twins was tested in a similar manner. In this phase of the experiment, cubical blocks were used. The ability of the twins to manipulate the blocks was systematically observed. As in the previous experiment, the twin whose training period began later and was shorter manifested superior skill.

Using the same pair of twins<sup>1</sup> and essentially the same technique, Strayer examined the effect of training and maturation

<sup>1</sup> When identical twins are used with one as a control twin and the other



on language development. Twin T was given five weeks of training which continued through her eighty-eighth week of age, and twin C was given four weeks of training which began at the age of eighty-nine weeks. The difference in the amount of training was only one week, but it began for twin C about the time when it ended for twin T.

The language training consisted mostly of naming pictures and objects, following directions, and the association of words with behavior, such as "How do you do?" with shaking hands. While twin T was being trained in language, twin C was not spoken to. In this experiment also, maturity or age determined ability to a greater extent than did training. Twin C showed a superiority over twin T, thereby indicating that in verbal development, maturity with less training results in more learning than does more training and less maturity.

Not all results substantiate those given. In some instances where identical twins were raised together and one was given special training with the purpose of developing mental and sensorimotor abilities, there was a marked difference in the abilities of the two. The one trained had decidedly greater motor ability, for example, having much superior ability in skating(3, 4).

Educationally, we acknowledge the factor of maturity by fixing the age for school entrance at about six. Teachers have recognized, however, the fact that children of the same C.A. have not reached the same degree of mental maturity. In some schools, recognition is made of mental maturity rather than C.A. by allowing younger children to begin school if their M.A. is  $6\frac{1}{2}$  or over. Some teachers also maintain that children should have reached a degree of mental maturity expressed by an M.A. of at least 6 before any attempt is made to teach them to read. Much time is wasted in trying to teach reading to pupils whose mental development has not reached a stage where they can learn readily. They do not possess reading readiness.

Some experiments indicate that if children are not taught systematically and formally until they are older than the usual age for beginning certain subjects, they will learn more rapidly and will eventually be ahead of those whose training in a given

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as an experimental twin, it is assumed that the twins are equal and alike. There is some variation even in identical twins; nevertheless, the experiment is interesting and probably valid.

subject began earlier in their school experience and, therefore, extended over a longer period of time.

For example, it was found that at the end of the second grade, children whose formal arithmetic was begun in the first grade were not ahead of pupils who had had none until the second grade. Thus, one group was taught formal arithmetic for two years, in both the first and the second grade, whereas the other group had formal arithmetic for only one year in the second grade.

Tests given at the end of the second-grade work indicated that in both the oral and the written tests, those who had begun formal arithmetic in the second grade were superior to those who had had it in the first and second grades. This experiment and others indicate that we must be wasting a tremendous amount of time in our schools teaching children subject matter that is too difficult for their level of maturity. If for the average and under-average children we delayed the teaching of most of the present subjects a year or two, we should probably discover that in the end our graduates had learned more, acquired better habits of scholarship, and were in better mental health.

One of the evils of sending children to school too early in life is not that the school is not a good place for them to grow and develop in but that the present emphasis on subject matter places them under pressure to learn to read, to spell, and to acquire arithmetical facts before they are mentally or physically mature enough to do so. We have psychological evidence that many pupils are not mentally mature enough for the work that they are doing and that they would gain more if the school waited a year or more. It may be that the sensory development of the children—their eyes, their ears, the structures underlying their emotions and their neurological development—is not adequate for the rigorous and formal tasks that many schools impose. A highly important factor in the learning and achievement of children, then, is maturity. The schools and home would consequently conserve their own efforts and that of the children by waiting until the latter are mentally, socially, and emotionally mature enough for the tasks imposed upon them and for the situations in which they are placed.

**Adult Ages and Learning.**—There is no entirely satisfactory definition of adult age. It may be assumed here that the term

applies to the age when maturity has been reached. For most practical purposes, any age above twenty may be considered adult. After that age, a person does not become mentally more capable from merely growing older, as he does during the preteen age and also during part, if not all, of the teen age.

It is a common opinion that we learn with greatest facility during our childhood and youth. Good memory is usually associated with childhood, and forgetfulness with adulthood. Common statements such as "You can't teach an old dog new tricks" convey the idea that adulthood is more or less impervious to learning. In the past, we have had little experimental evidence on the capacities and learning abilities of adults, and consequently there may be many faulty opinions. During the past ten years, however, a number of such studies have been made, so that we now have actual evidence to interpret.

In general, the studies are of two types. One type of investigation consists of giving general aptitude, or intelligence, tests to adults who cover a wide range of ages. If the adults throughout the age range are potentially equal in capacity or equally well selected, the trend of the scores with age will indicate the trend of mental abilities with age. The other type of investigation consists of testing the ability of adults of different ages to learn a foreign language; to memorize series of nonsense syllables, arithmetic combinations, and words; and to learn the content of the usual school lessons.

The results of different investigators are conflicting, although most of them indicate that there is some decline in both general mental ability and learning ability after the twenties. The high point in mental development, as measured by aptitude tests and learning experiments, seems to be reached in the twenties, or the third decade of life. The data of various studies indicate that the first half of that decade is slightly superior to the second half. The decline generally observed up to the age of fifty is steady though not very rapid; but after that age, the decline increases. Some results indicate that certain abilities, particularly vocabulary and general information, increase with age; whereas others, such as memorizing spoken directions, translating sentences according to a code, and seeing the relationship of different geometrical forms, decline with age. There is some indication that mental abilities not practiced decline with age,

whereas those that are practiced do not decline but may even improve.

Specifically, we may inquire about the ability of adults to learn new materials in the same sense that children learn their lessons. Can adults learn readily, or do the years following the age of mental maturity impose a penalty on the powers of adults to learn? On the basis of all findings, it may be concluded that adults in their twenties and thirties can learn much more effectively than elementary-school pupils and more effectively than even high-school pupils. Some decline in learning ability has been observed for people in their thirties and older; but conceivably this decline is caused not by actual loss of learning capacity but by rustiness or lack of practice.

The studies of adult abilities suggest that there is no need of being in a hurry about introducing young six- and seven- and eight-year-olds to formal education. Even if any essential curricular materials are omitted, they can be readily and more profitably learned during the adult years. If we would recognize the capacities of adults to learn and the greater vitality of learning by adults, we should adjust our teaching material more adequately to the maturity level of pupils rather than crowd everything into the elementary- and secondary-school curriculum, whether it fits or not.

The record of human intellectual achievement suggests that mental powers are at their height during the years from twenty-five to forty or perhaps from twenty-five to fifty. It is during those years that mathematicians, chemists, physicists, inventors, writers, and artists are most creative. This statement does not imply that great achievements are not made after the age of forty or fifty, for individuals who have made important contributions to knowledge in their twenties and thirties continue to be creative afterward also. Nevertheless, for the most part, men are not so productive after forty or fifty as before. They seem to have passed their intellectual prime and to have lost some of their former energy. Similarly, from the formal studies that have been made of intellectual achievement, the intellect seems to be at its best during the twenties, thirties, and probably the forties. Mental-test results and also the results of learning experiments indicate some decline during those years. It is educationally sound to conclude, however, that during the years of adult life,

and especially during the third, fourth, and fifth decades of life, learning powers are higher than during the usual school years.

### SUMMARY

The curves representing growth and learning are free of fluctuations even though daily variations occur in the individual's learning and achievement. These curves have been smoothed, as we say, in order to show better the general trend. The factors that cause variation are external and internal to the individual.

A curve representing slow initial progress, but with subsequent rapid progress, is concave. One with rapid initial progress is convex. The part of the curve that represents no progress during the course of learning is called a plateau. Various factors, such as the learner's previous experience, difficulty of the material, and lack of interest, influence the nature of the curve representing the course of learning.

There are limits in learning, one known as the practical and the other as the physiological. The practical is the limit that we reach through ordinary effort. The physiological is the limit set by the limits of human power, such as the limit of speed of eye movement, speed of speech, speed of finger movement, speed of running, and of any other physical process involved in learning.

One of the most important factors in learning is the course of growth and maturation. A child's learning power is increased significantly by merely growing older. The experiments on twins show that for some physical and mental abilities, increased age is more important than training, although there are some studies that do not substantiate that finding.

When mental maturity is reached sometime during the late teens or early twenties, there is little or no increase in learning powers from merely becoming older. The ages from twenty to forty, however, are the most effective years for learning the content found in high-school and college or university curricula. There probably is a slight decline beginning at about forty and continuing until the sixties are reached, when the rate becomes considerably greater. The reason for the decline may lie in loss of energy and weakening of the senses, such as the eyes particularly; and possibly there is a natural depreciation of the brain.

In short, a rapid development in learning occurs through growth which follows quite closely the mental-growth curve

represented by Fig. 13. There are differences, of course, for specific abilities and variations are determined to a large extent by intensity of practice.

### Problems and Exercises

1. When the course of learning for children is considered over a comparatively long time, why is it impossible to separate growth and learning?
2. Which do you regard as the more important reason for the variation from day to day in the learning ability and performance of children and adults?
3. How may a learning curve representing the progress of a learner differ from the curves given in Figs. 12, 13, and 15?
4. Give illustrations of the various curves: concave, concave-convex, convex, and plateau.
5. Point out the factors that are responsible for the characteristics of these curves.
6. Differentiate between practical and physiological limits. Give illustrations.
7. What natural factor increases the learning ability of students from infancy to adulthood?
8. Do you think it would be psychologically sound to defer the teaching of reading to many children until they are eight years old and probably defer the teaching of formal arithmetic until they are nine?
9. In view of what we know of adult mental abilities, give your reaction to a proposition for spending more of our school money for the education of people after they reach the age of twenty.

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## CHAPTER XIII

### MEMORY

**Directions for Study.**—The difference in the loss of various abilities through forgetting shows the relationship of meaning to retention.

What are the probable explanations for a greater retention by grade-school pupils than high-school students and by high-school than college students?

Note the effect of summer vacation on various abilities.

For learning and retention, the recitation has an importance that should not be overlooked.

What are the courses of forgetting taken by various abilities?

The term *overlearning* should be understood and also its value in preventing loss through forgetting.

There are various facts about reviews and retention that are both theoretical and practical.

Some discussion is devoted to incidental review resulting from extensive study.

**Forgetting and Retention.**—Much that students learn and are able to reproduce in the form of adequate answers to examination questions is soon forgotten following the examination. The poems that children learn well enough to recite in class or on a program are soon forgotten. It is easy to sense how little is retained of that which is memorized if we check ourselves on our ability to repeat the poems and other "pieces" that we learned as children. The poems remembered are probably those which we have had occasion to use or which we have made a habit of repeating. Most of the hundreds and thousands of facts acquired through the labors of pupils and teachers throughout a school career are forgotten.

An illustration of how completely time may erase some memories was related by a person who, by chance, found a copy of the play in which he had had a leading part in high school. Twenty years had passed since he memorized and spoke his lines,



and he reread the play in order to reacquaint himself with it and, in particular, to go over his own lines. To his astonishment, he discovered that the whole thing was almost completely unfamiliar. It was almost like reading a new play. A period of two decades had obliterated nearly all memory of lines that had once been well learned but that had not been reviewed or associated with anything.

Not all material learned or memorized is wiped out over a period of 20 years. Much is forgotten if not reviewed. There are also individual differences in the power of retention, some people retaining much better than others. Still, time will destroy the ability to recall most materials that are memorized, such as poetry, passages, dates, and formulas. General and personal experiences that may be recalled by association and are surrounded with feeling and emotion are not so easily forgotten. An adult may remember many of his boyhood experiences and still forget much that is purely mental, such as the content of mathematics, physics, and history courses.

The course of forgetting takes a definite trend. It is most rapid at first and then slows down. In the case of nonsense syllables and poetry that have been memorized well enough so that they can be repeated, as much as nearly one-half is forgotten within a few hours. This initial decline is most rapid; after the first day, it is much slower. After 15 days have passed, one-third to one-half of what was known is retained; and at the end of a month, only about one-fourth is retained. These general facts are true on the average, but account should be taken of individual differences.

The forgetting of subject matter or material whose learning is less rote but more facilitated by association is not so rapid. Nonsense syllables, *sij*, *nuk*, *faq*, etc., are forgotten more quickly because no associations such as cause and effect or time sequence are made while learning them. Historical materials, scientific processes, meaning of words, and other materials are retained better because they are tied together by associations. The recollection of some facts tend to bring up others. Nevertheless, even a large percentage of subject matter learned in school is forgotten. When tested at various periods following the end of a given course, for example, pupils show that the amount retained becomes continuously less.

Sensorimotor skills are retained best; meaningful materials, next; and meaningless materials, most poorly of all. The muscles, figuratively speaking, have a better memory than the mind,

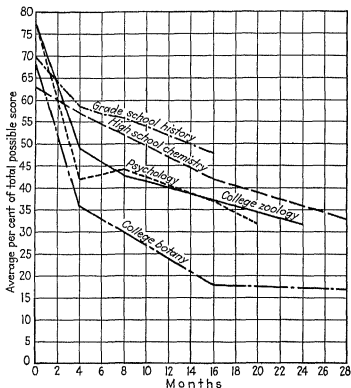


FIG. 16.—Retention of one elementary-school subject, one high-school subject, and three college subjects for 16 to 28 months after the end of the course. (After Bassett, Grene, Powers, and Johnson. Reprinted by permission from S. L. Pressey, *Psychology and the New Education*. Harper & Brothers.)

and content rich in meaning is remembered better than material without significance.

The loss of knowledge of any subject following the end of a course cannot be described precisely. In the first place, the rate of loss differs a little from subject to subject, and it also differs according to school level. Apparently, the loss in ability of grade-school children is least; the loss by high-school students is a little more rapid; and the loss by college students is greatest of all. Figure 16 contains data on these points(1). The loss

of all groups in various subjects is characteristic of most retention curves in that it is greatest at first and slows down and becomes very gradual a year after the courses were completed. The high loss at first is to be expected, as there is more to forget. The student has built up his stock of knowledge to a high point for the examination. A rapid recession from this high point takes place following the end of a course which leaves progressively less to be forgotten. The rate of forgetting may vary from subject to subject; but generally speaking, at the end of a year, between one-fourth and one-half is retained; at the end of two years, the amount retained is even less, and some loss is still going on.

The smaller loss of grade-school subject matter may be accounted for in at least two ways. In the first place, it is reviewed more frequently than the subject matter in high school or college. Arithmetic, geography, and history, for example, are continued throughout a number of grades; consequently, the loss of an appreciable body of knowledge in any of those fields is less likely because of both incidental and direct learning in those subjects. On the other hand, in colleges, for example, the student may take one or two courses in statistics, history, or economics and subsequently have little contact with them. The loss is greatest when the materials of a course do not come again within the student's experience.

Another reason that the loss of learning is less for grade-school children than for older individuals is the rapid mental growth and development of children. This development is sharply upward for grade-school children, especially those in the lower and intermediate grades. In high school, this curve of development is reaching a plateau; and in college and during adulthood, mere increase in age brings no increase in mental power because of growth. Thus, during the grade-school and, to some extent, the high-school years, the strengthening mental power retards the course of forgetting.

**Activity Following Study and Retention.**—The learner's experience following the period of studying and learning influences retention or forgetting. Some experiences stimulate forgetting. ✓ A period of sleep tends to retard it, whereas periods of other activities, such as the active study of other lessons, result in less retention. Probably the common opinion that the best time to

study is early in the morning is not entirely sound. The time before bedtime may possibly be the best for study, because no stimuli play on the mind during sleep to demand attention and crowd out the material learned. This point may not be significant except to emphasize the desirability of fixing the material learned before other material has a chance to cause confusion or usurp the attention unduly.

**Summer Vacation and Forgetting.**—Some educationists regard the usual summer vacation of about three months as detrimental because the children lose so much information and skill during that period. It is true that some abilities are lost during the summer vacation and that it may take from two to fifteen weeks to regain the educational status that they had when vacation began. For most children, however, it takes only a short time to regain the summer vacation losses.

Not all abilities show a loss, however. Reading ability and reasoning power are maintained through the vacation period, whereas more formal abilities, such as a knowledge of specific facts in history, geography, and arithmetic, decline. Thus, the ability to reason effectively in arithmetic does not decrease; the knowledge of tables and combinations does decline. The reading and general activity of students maintain their reading and reasoning ability, but the more specific and formal abilities decline because they are not practiced.

In connection with forgetting or loss of knowledge through disuse, studies have been made of the losses by children over the summer vacation. Some investigators who have studied this problem have discovered considerable loss and have been disturbed by what they consider a canceling of part of the gains made during the school year preceding the vacation. They determine the effect of vacation on the store of the pupils' knowledge by testing them before and after the summer, calculating the differences in achievement.

Not all studies of this question, however, have revealed a loss over the vacation. One made of eighth- and ninth-grade pupils shows that minor gains were made in vocabulary, language ability, history, civics, geography, literature and that the only loss of any considerable amount was in arithmetical computation, or the more mechanical phases of arithmetic(2).

There is no cause for worry if a loss in ability occurs over the vacation period, because it is only temporary in nature. When children resume school in the fall, they are older by the length of the vacation—usually by about three months—and in many instances have had useful out-of-school experiences. They soon regain their vacation losses, if any, and proceed with greater facility to new ground. Possibly an absence from work is desirable because pupils are maturer and fresh when they resume their work.)

A group of seventh-grade pupils was taught for a semester ending in June and then tested on its ability with general-science subject matter. They were retested again in September following the summer vacation(3). Two tests were given every two weeks during the semester, one of which was used to test the acquisition of new material and the other to test retention of the old. Three different types of test were used: one to test the amount of factual information acquired, the second to test the ability to explain scientific phenomena, and the third to test the ability to draw conclusions from given data. The test used to measure the acquisition of facts and information was of the completion type. That used to measure the ability to explain scientific phenomena "consisted of a statement followed by five plausible explanations, only one of which was correct." And the test designed to test the ability to draw conclusions from given data "consisted of a statement followed by five plausible conclusions, only one of which was correct." A long comprehensive test was given in June and again in September; comparison of the results in June with those in September following the vacation indicated an average loss of 14 per cent for all three types of tests in the field of general science. The loss of factual information was a little over 17 per cent, which was also the amount of loss in ability to draw conclusions from given data.

The loss of ability to explain scientific phenomena decreased only 9 per cent during the same vacation period. Apparently, the ability to explain scientific principles is lost to a lesser extent than one's knowledge of facts and information. It is a little surprising that the same statement does not apply to the ability to draw conclusions, because ordinarily that should not decline so rapidly as knowledge of facts and information.

✓ The loss over the vacation taken as a whole was less than usually found, probably because the subject matter was thoroughly learned. The procedure of giving two tests every two weeks to measure acquisition of new material and retention of old had resulted in thorough learning.

✓ Analysis was made also of the loss according to mental ability, and the losses were least for the group with the highest and greatest for the group with the least ability. (Those who know most tend to retain most; those who know least, to retain least.)

It must be recognized that a time will come at graduation or other time of leaving school when students will cease studying systematically and that abilities not exercised will decline. Such loss is inevitable, and it is hoped that the students have drawn sound conclusions and made wise generalizations on which to base their judgments. For instance, a person may have forgotten many of the details of his courses in physiology but may have arrived at certain conclusions about exercise and diet. In addition, he may have developed certain ideals and attitudes about the human organism that influence his mode of living or his point of view toward evolution. Even during their school career, students lose some knowledge of a course after they have taken the final examination in it and started new courses. Losses are certain to occur through disuse, but there are certain residual gains in the forms of attitudes, conclusions, and generalizations that last much longer.

**Differential Retention.**—The retention of material studied was tested when the interval following the test was one year(4). The examination was devised to measure the ability to select from a list of true and untrue statements pertaining to chemistry those which were untrue; the ability to indicate facts and principles of chemistry that correctly apply to the solution of problems; a knowledge of terminology, such as definition and description of chemical terms; knowledge of symbols, formulas, valence; and the ability to balance equations.

To test the amount of retention, the students were examined a year after the completion of the course, and Table XI indicates the percentage of retention in terms of the gain made from the beginning to the end of the school year. For example, the girls retained 64 per cent of the gain that they had made in the selec-

tion of facts during their year of chemistry; and the boys, 70 per cent of their ability to balance equations.

TABLE XI.—RETENTION IN PERCENTAGE OF GAIN MADE DURING THE COURSE\*

|                                          | Girls | Boys | Both |
|------------------------------------------|-------|------|------|
| Selection of facts. . . . .              | 64    | 93   | 84   |
| Application of principles . . . . .      | 93    | 91   | 92   |
| Terminology . . . . .                    | 46    | 75   | 66   |
| Symbols, formulas, and valence . . . . . | 65    | 73   | 70   |
| Balancing equations. . . . .             | 76    | 70   | 72   |
| Total . . . . .                          | 67    | 87   | 81   |

\* Adapted from Frutchey, 1937.

Least was retained in terminology, or the ability to identify chemical terms, as it was measured, and most in the application of principles. These facts are important, as they indicate that the (power to use and apply knowledge is lost less rapidly than the knowledge of terms.) This fact has an important implication for both testing and teaching. Sex differences occur also in the percentage of gain retained, but the largest differences evident in Table XI are probably accentuated by certain accidental factors and probably do not represent the true differences. Generally, sex differences are not so large as these.

**The Recitation and Retention.**—A pupil may spend all his study time studying, or he may spend part of it recalling and reciting what he has read. Least is retained if the former method is used, both immediate and remote memory are improved by recalling and reciting. One-half to even over three-fourths of the time apportioned to a lesson can be used with profit in recalling or reciting the content of the lesson.

The recitation can be made very effective not only as a means of setting forth and explaining the material to be remembered but also for developing in students the mind-set for possessing the lesson content during the recitation. In addition, some of the principles of the recitation can be applied in supervised study and also in individual study by training the students to recite to themselves or by systematically trying to recall the contents of the lesson. This process requires active attention and the will to

learn, which are often absent when the lesson is merely being read. These points are discussed at greater length in the section on how to study.

**Meaningfulness and Retention.**—Many experiments have been conducted on the retention of meaningful and non-meaningful material, and the results indicate that non-meaningful material,

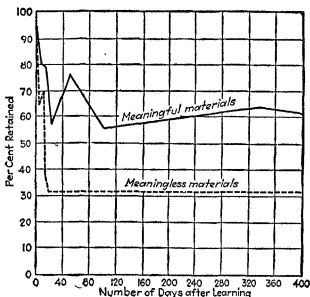


FIG. 17.—The retention of meaningless and meaningful material as measured by the recall method. The curve for meaningless material is based upon 18 studies and that for meaningful material is based upon 24 studies. (From Robert A. Davis and C. C. Moore, *Methods of Measuring Retention*, *Journal of General Psychology*, 1935.)

such as nonsense syllables, is forgotten much more readily than is meaningful material. The retention of nonsense depends on sheer memory, whereas the retention of meaningful material is helped by associations. Facts related to known facts, words arranged in poems, and ideas suggested by others are remembered longer than isolated facts, words, and ideas. In Fig. 17, retention of meaningful and that of meaningless material are compared(5).

Thus, in teaching it is essential not only to stimulate learning but also to cause retention. When the pupil says "The teacher made it so clear and vivid when I learned it that I can hardly



forget it," he is psychologically correct. Vividness in learning is the first requisite for effective retention; and obviously something must first be learned before it can be retained.

In this connection, it may be mentioned that intent to learn and to remember determines to a considerable extent the amount achieved. If the attention is passive, the repetition perfunctory, and there is little or no intent to remember, little learning and retention are achieved. Interest and mind-set are necessary for retention.

The present educational organization with its many required courses, which are completed by an examination at the end, develops in pupils not an intent to remember but even a mind-set to forget. Students feel relieved that a course is over and make little or no effort to retain what they have learned. Consequently, forgetting goes on at a fast pace, with no attempt by the student to prevent it.

**Thorough Mastery, Overlearning.**—One of the best ways to prevent forgetting is to learn thoroughly. That which is barely learned is rapidly forgotten. When a pupil learns a poem so that he is just able to repeat it without error; if he has his lesson hurriedly learned and can set forth some, if not all, of the facts; if he can type without error sometimes if unusually careful; and if he can barely play a piece on the piano correctly, this material on which the hold is weak will be quickly forgotten. The learning should be carried beyond this stage, so that the facts, information, ideas are thoroughly understood and firmly retained. Just as one drives a stake deep so that it is firm; ties the rope with an extra knot; drives in an extra nail; and, in general, exercises extra care to prevent loosening, so, to prevent forgetting, the learner should study and review the material until it is firmly and thoroughly acquired.

*Overlearning* is a term applied to learning beyond the stage where the material can be said to have been learned. If a child has learned the arithmetic tables so that he can give the answers without error, he may be said to have learned them; and continued study of them may be described as overlearning the combinations. Up to a certain extent, time spent in overlearning, or in fixing, the material learned is profitably used. If, for example, an hour is needed to learn a number of foreign words, a poem, or some essential facts, up to a half hour, or up to 50 per cent

more time, can profitably be used to overlearn them. The forgetting prevented by more thorough learning is of such an amount that it pays to spend time studying a topic after it has been barely learned. Then there is obvious value in having a firm grasp of a subject rather than a faint hold, even if the latter were not so easily lost.

✓ **Review and Practice for Retention.**—Forgetting some facts, names, places, and events cannot be avoided. There is no possible way to retain all that we have learned. ✓ People differ widely in their power to retain as well as to learn; but no matter how retentive they may be, human beings are able to recall only a small portion of all that they have learned since birth. Knowledge that has been acquired but is seldom used or rarely brought to the attention may be forgotten, but it can be revived when needed; and generally relearning will take less time than the original learning. For the most part, we retain that which we need and have practiced most or that which has been vividly impressed on our memory by certain associations or by emotionalized situations.

There is some information, such as arithmetic combinations, various poems, words, technical terms, languages, and outstanding historical events, that one wishes to retain. After acquisition and understanding, reviews and drills may be spaced to decrease forgetting. An important principle to observe is that the first period of review or practice following the learning should come after only a short lapse of time. If new words of a foreign language have been learned, they will be lost if a long period elapses before the review. If they are reviewed within a short time, say the next day, forgetting will be checked. The time interval between succeeding practices can be increased progressively. Thus, if the first interval is one day, the next one might be two; the following one, four days; then eight; sixteen; thirty-two; and so on. A distribution approximating geometrical progression or doubling the previous interval is a fairly satisfactory one. If the interval is too long, the learner will find that forgetting has set in to such an extent that considerable practice is required to relearn. The intervals should be of such length as to reduce to a minimum the necessity for relearning. In general, intervals of increasing length are more conducive to economical relearning. One hundred minutes of review carefully apportioned will prevent more

forgetting than one hundred minutes used as a single period or distributed unsystematically after long periods of no practice.

In addition to the formal and systematic aspect of learning and forgetting, there is a more indirect and informal method of facilitating the process of learning and retention. To illustrate, consider the case of the pupil who learns words formally. He increases his vocabulary by learning the meanings of a list of words by rote. When he can define all the words without an error, he reviews them systematically to prevent forgetting their meaning.

Such practice and review is effective, but it should not cause us to overlook the learning that is more incidental in its character. The extent of a person's vocabulary can also be increased without planned drill and review. Most of the learning of words by both children and adults is done informally or incidentally. Words are learned by hearing them in speech and by reading them in papers, magazines, and books. The meanings of new words are studied in the dictionary or are defined by someone who knows the definitions. Because the words are used in spoken or written sentences along with other words, their meanings are fitted into a particular context. Associations are made, and the meanings become functional. The most effective method of acquiring words and retaining their meaning is to read widely so that the words are experienced in various uses. It may also be added that discussion, debating, writing, and reciting stimulate the acquisition of word meanings.

The same concepts apply in other fields. Pupils can, on the one hand, learn the principles of composition by memorizing rules whose retention can be assured by systematic reviews, for a time at least. A more psychological approach, however, consists of having pupils write compositions and letters that grow out of projects and that are thus motivated. The teacher can then utilize the principles of composition to explain their strength or weakness and to suggest improvement. Thus, the principles are learned in connection with actual writing. Having been learned by exercise and practice rather than by rote, they can be more readily retained and recalled.

Continual review of materials that have been learned is not the best preventative against forgetting the vast amount that we learn from year to year. That procedure is impossible because

we should soon reach a point where we would have to devote all our time to reviewing old material and could spend none to expand our knowledge and skills. Sustained study in various fields will usually suffice to maintain old proficiencies and abilities and will develop new ones. Because of interrelationship of knowledge, much that has been formerly learned will often be incidentally reviewed and reinterpreted.

Still, it must be recognized that a time is reached when the amount forgotten is about equivalent to the amount acquired. Such a place of equilibrium represents the limit of development through learning.

### SUMMARY

Much that is learned is lost through forgetting. For some kinds of material and over long periods, the loss is almost complete. Forgetting varies in amount and degree; and, in a general way, relearning is a function of those two factors.

Forgetting is most rapid at first and more rapid for meaningless than for meaningful material. About one-half of meaningless material is forgotten in several hours; and within a year, usually about one-half of the content of lessons is forgotten.

Losses in some abilities, especially the skills such as computational arithmetic, occur over the summer vacation; but more general school abilities decline comparatively little or not at all during the vacation. Losses are soon recaptured, and conceivably the temporary losses during school vacations result in no net loss over a whole school career. Vacations may even have a beneficial effect in the end.

Less loss occurs in the power to select, apply, and interpret facts than in the power to recall them. Consequently, teachers can direct learning most effectively by less emphasis on memoritor and mechanical learning and more stress on application and interpretation. Meaningfulness is a factor in retention; and by wide application and rich interpretation, facts, information, and concepts become meaningful.

The recitation facilitates learning and retards forgetting. In the division of time devoted to the learning of lessons, possibly about half of it can be devoted profitably to recitation with its recall and discussion of the subject matter.

In order to retard forgetting, the material studied should be thoroughly mastered. It should be overlearned, that is, studied beyond the point where it can just be recited or comprehended.

Reviews are most effective when the first one comes soon after the original learning, because it prevents the large initial loss. Subsequent reviews can be spaced increasingly farther apart. An effective way of retaining much that has been learned is to be so alive as a student and scholar that you encounter old material in various relationships and thus retain your grasp on much that otherwise would be forgotten.

### Problems and Exercises

1. Give some examples of complete or almost complete loss through forgetting.

2. Why do you think that we tend to forget the content of a history lesson or the ability to recite a poem sooner than we forget our ability to skate?

3. Give your explanation for the different levels taken by the curves in Fig. 16.

4. How should you arrange your program so that events and activities of the day influence learning and retention favorably?

5. Suppose that we did away with summer vacation for grade- and high-school pupils or shortened it to a week or two. What difference do you think it would make in the quality and value of the education received by the pupils? Think of the effect on pupils of attending school 12 years and graduating from high school without having had vacations.

6. What is your explanation for the discovery that the ability to select, apply, and interpret facts and information is retained better than the memory for the facts?

7. How could you improve the recitation so it would be more effective?

8. If meaningful material is learned and retained better than meaningless, what can students and especially the teacher do to facilitate learning and minimize forgetting?

9. Give some examples of overlearning.

10. Apply the principles of review to some real situations.

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## CHAPTER XIV

### INTEREST, ATTENTION, INCENTIVES, AND MOTIVATION

**Directions for Study.**—First skim over the chapter, and observe the items that are discussed.

Consider the nature of the life situations in which interest and attention are at a maximum.

Look for the specific methods used in school to obtain maximum interest and achievement.

Explain the difference between active and passive attention, and also describe the characteristics of the usual classroom attention.

Analyze the comparative effectiveness of competition and cooperation.

Think of praise, reproof, rivalry, prizes, recognition, social influences, and other factors in terms of the age, brightness, dullness, and sex of the learner.

What effect do policies of promotion, failure or no failure, have on achievement?

**Introduction.**—A number of adolescent boys in a potato field were listlessly moving along, picking the potatoes into their bushel baskets. They moved along together from one end of the field to the other. When they were within easy sight of the end, one boy shouted, "I'll be first to finish the row!" Immediately everyone abandoned his slow tempo and speeded up as fast as he could. All picked more than twice as fast as before, each trying to reach the goal first. The winner gained a feeling of great satisfaction.

✓ Of major concern not only to educators and psychologists but to people in general are the conditions and factors that cause maximum achievement. ✓ Some conditions of work cause greater achievement than others. ✓ Under some conditions, a child or adult is greatly interested and works with zeal; his attention is

active; in another situation, his attention is passive, and he works listlessly. ✓

✓ Under a given teacher, the pupils manifest great interest and attack their work with avidity. The same pupils with another teacher show little interest and behave as if they had no purpose in life. ✓ Similarly, when directed by a certain conductor, an orchestra or choir will seem highly motivated, but the same organization responds indifferently to other leaders.

Thus it is throughout many spheres of life; responses can be evoked with different intensities. ✓ Some persons are stimulated by praise and favorable recognition; others, by reproof and unfavorable criticism; still others respond to material rewards. Usually, we work hard to outstrip others, and many will put their utmost into an activity in order to obtain the distinction of winning a prize, receiving honorable mention, or being selected as a member of an honorary society.

Boys on the college football team expend every bit of energy that they possess in order to keep their place on the team, receive a letter, and earn the praises of the audience and of the newspaper reporters of sports events. Hardly any professional athlete, no matter how big the prize he is working for, plays and works harder than the high-school and college athlete, who is spurred only by his desire to receive the recognition and approbation of his fellows. Even the professional athlete works as hard for distinction and to possess a top rating as he does for his salary.

✓ Many factors cause young and old to work hard, and possibly several of them are associated with the drive or motive to obtain personal satisfaction through a feeling of prestige and worth. ✓ Praise serves that purpose; reproof or scolding may spur one to change his behavior to avoid scolding. A prize may be valuable in itself, but still it is more coveted if it brings recognition to its owner. Some of the greatest incentives in history have consisted of medals or a small wreath of laurel.

✓ In the schoolroom many techniques are used to spur pupils to greater achievement. They are praised; scolded; ignored; given prizes; placed on the honor roll; given special privileges; kept aware of their records and the progress that they are making; pitted against each other in individual and group rivalry; encouraged to work for a goal or with a purpose; and, in general, made to attach pleasure and satisfaction to accomplishment. ✓



✓ The purpose of the methods and techniques used is to evoke maximum attention to one's work and thus produce maximum achievement. When teachers employ effective methods, the pupils have a set and readiness for their work, attacking it with purpose and motive and, consequently, with a determination to achieve. When teachers set up attractive incentives, pupils develop an initial drive for their objectives which, in turn, is maintained by the knowledge, skills, and abilities being acquired. An important influence in developing a drive is the competence that the pupil feels he is acquiring. ✕

The following discussion will attempt to set forth and evaluate the facts pertaining to various methods used to stimulate achievement. Many questions can be raised—and answered to some degree—on the effectiveness of rewards, praise, scolding, recognition, rivalry, purposes, knowledge of progress, and other factors that influence achievement. For example, are there differences in the effect of these influences on dull and bright children, younger and older pupils, boys and girls? Furthermore, some of these factors may have a desirable effect when first applied but, if continued, will have little influence and sometimes even an adverse one. Many phases of the problem of interest, attention, incentives, and motives must be considered.

**Passive and Active Attention.**—The attention of the car driver to the turns in the road, the markers along the way, the location of certain stations, and other places along the road differs from that of a passenger who may be sitting alongside him every time that he makes the trip. The driver pays active attention because he is responsible for getting to the destination. The passenger does not have this responsibility, and his attention is passive. The driver can give many details about the road of which the passenger has made no note.

Much that is about us is not observed in an active way because we do not look with a purpose. When a teacher of nature study points out certain birds, flowers, and trees, observation becomes active, and that which was not seen before is now noted. Interest is stimulated and increases in its intensity. ✓ A mind-set and a definite intent to learn take the place of passive and untrained attention.

✓ Incidentally, mere repetition does not result in memorizing what is repeated. For example, in learning a series of nonsense

syllables that were repeated orally to the subjects many times by the experimenter, it was discovered that the experimenter could not repeat from memory a series that he had repeated over fifty times, whereas the subjects, who had a mind-set for learning them, acquired the series in less than one-fourth as many repetitions. Experiences like this have been observed in a number of similar situations and verify the general conclusion that intensity of interest and will to learn are basic to efficient learning. ✓

There are many situations in life where little learning occurs because no active attempt is made to learn. The teacher reads sets of directions over and over again that she could readily learn and conveniently give from memory if she tried. Many speakers use notes or outlines which they could easily memorize if they actively attempted to do so, thereby avoiding the handicap of having to glance at notes. Active attention to peoples' names, accompanied by earnest attempts to remember them, enables some persons to remember an unusually large number; to a considerable extent, this is a matter of attention. In many of life's situations, the will to learn results in the acquisition of facts and material that usually are passed by.

Study of the attention of students indicates that it is weak a considerable proportion of the time(1). College students in arts, commerce, and law were asked to indicate the percentage of class period in which their attention was high, medium, and low. Such a method of ascertaining the evidence is not very reliable, but it is better than mere guess or speculation. There was considerable variation among the students, some reporting high percentages, others reporting low. The median percentage for each college group, classified according to whether the attention was low, medium, or high, is as follows:<sup>1</sup>

|               | High | Medium | Low |
|---------------|------|--------|-----|
| Law.....      | 79   | 13     | 11  |
| Commerce..... | 29   | 52     | 20  |
| Arts.....     | 20   | 65     | 22  |

According to these data, during 79 per cent of the class period the attention was high in the case of the law students. It was

<sup>1</sup> Adapted from Knight and Rammers, 1923.

high during 29 per cent of the class period in the case of the commerce students and 20 per cent of the period for the arts students. The table can be read correspondingly for medium and low attention. These are averages and give the general amount of the various intensities of attention.

There are many conditions that would cause attention to vary. Some teachers are more interesting than others; and they, too, may vary from day to day in the power to interest. Topics and lessons differ in the degree to which they attract interest; furthermore, advanced students probably are more active in their interest than are beginners.

Even though results would differ from class to class, the fact probably is that attention during a class period fluctuates considerably and is at a comparatively low ebb much of the time. The mind often wanders, and the energy of the learner is not concentrated on the topic at hand so much of the time as is necessary to reach a high state of efficiency. The educational problem is to motivate and interest the pupils so that their attention will be more effective.

**Rivalry and Competition.**—The school uses many contests in which rivalry becomes keen and tense. Athletics probably more than any other school activity is based on rivalry, both individual and group. The participants strive to defeat their opponents either as teams or as individuals. As a member of a team, the player is stimulated by the desire to improve his individual record as well as to have the team win. The baseball player wants to have a higher batting average than that of other players; the football player aims to make the most touchdowns; and the basketball players work for individual high scores as well as for team victory. Thus, in athletics, the rivalry is almost always individual as well as team rivalry.

In the more conventional subjects also, rivalry shows up in one form or another. Children compete against each other to obtain higher scores in the examinations and higher marks on the report cards. The older form of spelling contest was competitive—side against side and individual against individual to see who would be the lone survivor. In the everyday spelling lessons, the individual child strives to obtain the highest mark. Contests in debate, declamation, and music bring out the spirit of sharp rivalry.

Because the rivalries in contests have become so acute that hard feeling and critical spirit have been developed, the use of contests to stimulate achievement is not so common as formerly. In some states, debate, dramatic, and musical contests of a state-wide nature were sponsored. Today, less emphasis is placed on the contest and more on festivals and clinics. The spirit developed thereby is less the spirit to win and more the spirit to learn by receiving help and guidance.

Rivalry or competition has the virtue of causing those engaged in it to concentrate their energies on the activity in which they are engaged. Psychologically, rivalry has been found effective because achievement is increased by it. But from a philosophical point of view, a question may be raised about the desirability of using rivalry to a great extent, because it may develop the competitive or individualistic spirit to an excessive degree. Having raised that point, we shall leave it, however, and turn to examine the effectiveness of rivalry in stimulating achievement.

**Competition and Cooperation.**—An experiment whose results show the effectiveness of rivalry is one set up to discover the comparative results when an individual works for his own record in competition with others and when his score is combined with that of his group and compared with the score of another group(2).

The material used for the abilities tested were simple addition combinations of single digits, such as  $2 + 3$  and  $4 + 8$ . Because of the simple nature of the tasks, the amount accomplished was a good indication of effort and thus of the interest in the work.

The children taking part in the experiment were tested under four conditions: (1) unmotivated, (2) working for self, (3) working for the group, and (4) choice of working for self or the group. Thus, in this experiment, there was an opportunity to test the accomplishment under individual and group competition or cooperation and also the extent to which the pupils chose to work for themselves rather than for the group. Included were 1,538 children of the fifth, sixth, seventh, and eighth grades, and the age range from eight through seventeen.

The pupils were first tested to discover what their accomplishment was without any particular motivation. The scores constituted the basis for comparing the self-motivated and group-motivated scores.

When the competition was individual, or the motive was for self, each pupil was told that his score would indicate his rank as first, second, third, down to the last and that the fastest would be given a prize.

In the test of the strength of group motive, the students were organized into classes and urged to work hard for the prizes that would be given to classes having the best scores on the addition test. The children wrote the name of their class on the paper and not their individual names. The individual competition was greatly reduced, if not eliminated; so, in this case, the group, or class, competition was a cooperative attempt of the members of one class to beat the members of the other.

In another competitive situation, the pupils were permitted to choose whether they wanted to work during units, a minute in length, for themselves or for the group. There were seven 1-minute units, so there could not be an equal division between self and the group.

Table XII contains the scores for practiced, self-motivated, and group-motivated children and the differences between the groups. When the student was motivated by the desire to win the prize for himself, he did best; the amount accomplished when working for the group was greater than without motivation but not so great as for self-motivation. It should be emphasized that the differences are for the amount accomplished in a minute, so, because of the short period involved, the difference is really a large one. At the rate of the average difference of 2.9 given for 1 minute, the difference for 10 minutes would be 29.

Motivation, both for self and for the group, is effective, but pupils work harder to gain a high ranking and to win a prize for themselves than they do to win standing and prize for their class. Consistent with this result is the tendency of pupils to work for their individual score rather than the group score when they have an opportunity to choose whether they wished to continue to work for themselves or for the group. The ratio was about 3 to 1, with 74 per cent of the choices being for self and 26 per cent for the group. Thus, the pupils choose most often the motivation that is most effective.

Another investigator also found that rivalry was effective in stimulating achievement(3). Children of the fourth and sixth grades were used as subjects, and the tasks were arithmetic

problems. One group, known as the *control*, were given the tests by themselves but urged to try as hard as they could. The others, known as the *experimental section*, were divided into two competitive groups who competed against each other. The scores

TABLE XII—ARITHMETIC SCORES OF GROUPS WITH DIFFERENT MOTIVATION\*

| School  | No. of cases (total, 814) | Practice (unmotivated) group | Self-motivation (competition) | Group motivation (cooperation) | Self-motivation over unmotivated group | Group motivation over unmotivated group | Self-motivation over group motivation |
|---------|---------------------------|------------------------------|-------------------------------|--------------------------------|----------------------------------------|-----------------------------------------|---------------------------------------|
| I       | 314                       | 44.8                         | 50.1                          | 45.6                           | 5.3                                    | 0.8                                     | 4.5                                   |
| II      | 223                       | 37.3                         | 43.0                          | 40.4                           | 5.7                                    | 3.1                                     | 2.6                                   |
| III     | 277                       | 41.0                         | 45.9                          | 44.4                           | 4.9                                    | 3.4                                     | 1.5                                   |
| Average | ...                       | 41.2                         | 46.3                          | 43.6                           | 5.1                                    | 2.3                                     | 2.9                                   |

\* Adapted from Maller, 1929

of each group were written on the board as well as announced orally. A strong competitive spirit developed during the period of rivalry. It will be observed in Table XIII that the control

TABLE XIII.—SCORES IN ADDITION TEST OF CONTROL AND RIVALRY GROUPS\*

| Day         | Groups  |         |
|-------------|---------|---------|
|             | Control | Rivalry |
| First.....  | 7.43    | 7.24    |
| Second..... | 8.12    | 11.00   |
| Third.....  | 8.19    | 11.26   |
| Fourth..... | 7.99    | 11.17   |
| Fifth.....  | 8.06    | 11.39   |

\* After Hurlock, 1927-1928.

group gained little, remaining on a relatively constant level. The rivalry groups made all their gain at the beginning and showed no improvement thereafter, having apparently reached in

the simple processes of addition the limit of their achievement at the beginning.

In this experiment, the younger children improved their scores more than did the older ones, and the duller children also responded more to rivalry than did children of average and superior ability. Because the scores of the inferior are low at the beginning, more gain is possible; and when expressed in percentage, a smaller gain may make a larger percentage of gain than is the case of a larger gain for a brighter person whose initial score is higher. Thus, a gain from 5 to 7, or 40 per cent, is relatively larger than a gain from 12 to 15, or 25 per cent.

The results of the various experiments on individual and group rivalry tend to indicate that young children respond more to group rivalry than do older children, who are stimulated more by individual competition and the desire to win for self rather than for the group. This change in motivation is probably brought about by the emphasis placed by activities in and out of school on individual accomplishment rather than cooperative endeavor and group achievement. The general morale of our society is based on competition and rugged individualism. Stories emphasize the struggle of the individual—the poor boy who struggled and gained success for himself. The marking system, praise and reproof of the individual, and individual achievement are stressed so that individualism is developed and causes working for self to be a greater motive than working for the group. Conceivably, the cooperative attitude could be developed so that the desire to work for the group would be increased if cooperation were emphasized in the school procedures.

The effectiveness of incentives in the forms of prizes, captaincy of the groups, and ranking substantiates, in general, the results from other experiments showing that pupils working with definite incentives in mind achieve more than they do ordinarily(4). Thirty-five children of a 5A class were tested with multiplication problems of two digits by two digits for seven weeks on Mondays, Wednesdays, and Fridays. In this experiment, their usual achievement was first established by ascertaining the number of problems done without incentives. Then the children were tested to determine their scores when they were working for nickel chocolate bars, for captaincy of the class, and for other ranking in the class. The name of the person with the highest score was

announced as captain, and the ranking of each person was written on the blackboard next to his name. There were four situations in which the achievement was tested, as follows:

1. No incentives.
2. Chocolate bars.
3. Captaincy and ranking in the class.
4. Combination of the incentives given in 2 and 3.

A comparison of the achievement with and without incentives is shown in Table XIV. Rivalry score refers to the score made when the pupils worked to become captain or obtain a high rank in their class.

TABLE XIV.—AVERAGE NUMBER OF PROBLEMS WORKED WITHOUT INCENTIVES AND WITH SEVERAL KINDS OF INCENTIVES\*

|                               | No incentive | Prize of chocolate bar | Captaincy and ranking | Several incentives |
|-------------------------------|--------------|------------------------|-----------------------|--------------------|
| Mean . . . . .                | 23.6         | 35.9                   | 34.6                  | 38.9               |
| Gain over no incentive. . . . | ....         | 12.3                   | 11.0                  | 15.3               |
| Percentage of superiority..   | ....         | 52.0                   | 47.0                  | 65.0               |

\* Adapted from Leuba, 1930.

In this experiment, too, the pupils in the lowest quarter made the highest percentage of gain. Apparently, when students are spurred by incentives, their achievement is increased considerably. Most experimenters have found this to be the case. In this experiment, a combination of incentives proved to be most effective.

When a person works for a prize, which in this instance was a chocolate bar, it is doubtful that the intrinsic value of the prize lures the student to his highest achievement. Except when the prize is worth a large amount—and even then in not all instances—the desire is not to have the prize but rather to gain the distinction of winning it. This is evident from the fact that the children did about as well to obtain a high rank as they did to win chocolate bars. (The feeling of social recognition and of satisfaction that comes from winning is the most fundamental of incentives and motives.) The boy or girl wants to be known



as a winner, or one who ranks higher than the other boy or girl.

**The Effect of Working in a Group and of Working Alone.**—Some pupils are stimulated by the presence of their fellows and do better in a group; others can accomplish more when they work alone. Then, again, differences exist according to the task, some kinds of work being best done alone, others done better in a group. When a person is writing a book or conducting a complicated experiment, he seeks privacy; but in mechanical types of work, such as much of the factory work or phases of work in physical education where rhythm is a factor, group work is most effective. In this connection, it should be pointed out that the discussion at this time does not pertain to group and individual competition or rivalry. It refers merely to individuals as being in and working in a group as against those working without the presence of the group.

The evidence does indicate differences in achievement under the social influences of the group and when working alone. In general, work more mechanical in nature is done better by an individual in a group than when he is alone, but work that is complicated and difficult is usually done better alone than in a group. Speed is a more important factor in simple tasks, and it is stimulated by the presence of others. Difficult problems requiring more careful reasoning and reflective thinking are done best away from the presence of the class.

As is true in almost all situations, some individuals differ from the general trends. Some types respond better to the group situation than do others; the poorer students, for example, respond more readily when they are in a group, whereas sensitive persons do better alone. It matters also how the group is involved in the situation and the relationship of the individual to the group. If the group acts as an audience or in some other way that causes the individual pupil to be sensitive to the rest of the group, some pupils, because of this sensitivity and of particular weaknesses, are influenced unfavorably. Others, in turn, are by similar circumstances stimulated by the group to effective responses.

On the whole, the differences are not very large, whether the individual works in the presence of others or alone. Variations occur among individuals; but, in general, the highest quality of

work is done by working alone when the tasks are difficult; when quality and difficulty are not involved to so great an extent and high speed is desirable, working in a group is most effective.

**The Effect of Praise and Reproof on Achievement.**—Some teachers and parents are given to speaking pleasantly and approvingly to children; some are inclined to blame or reprove them; others are hardly positive or negative. Words are used to approve or disapprove the behavior of children in order to improve it. The teacher who praises a child for his work does so in order to stimulate him; even more, when she reproves him, she does so to check undesirable behavior or to spur him to greater achievement.

In this connection, it may be pointed out that one of the distinguishing features of very good and very poor teachers is the nature of the responses that they make to the efforts of their pupils(5). The superior teachers nod approval, speak encouragingly, and in general react positively. The poor ones, on the other hand, are inclined to be negative in their reactions, deprecating their pupils' efforts, scolding them, and finding fault with their work. Of course, these are not the practices which cause some teachers to be good and others poor, but rather they are symptomatic of good or poor teaching. On the whole, commendation is more effective than faultfinding, but merely changing one's tactics in this respect would not make a good teacher out of a poor one or a poor teacher out of one that is now effective. But let us turn to the evidence on the effectiveness of praise and reproof on achievement. .

The typical experiment consists of having groups of pupils working on tasks, usually arithmetic problems, when praised, scolded, and neither praised nor scolded. In one experiment, a group present in the room was ignored when the other groups were either praised or reproved—nothing at all was said to the ignored group.

An experiment often referred to is one with an arrangement like that just given—a praised, a reproved, an ignored, and a control group(6). Over a period of five days, pupils of the fourth and sixth grades worked addition problems of six three-place numbers. All the students of the experiment were first tested and, on the basis of their scores, divided into four groups: a control, praised, reproved, and ignored. The control group was

placed in a separate room, but the praised, reproved, and ignored groups were given the tests in the same room.

The praised group was commended in the presence of the reproved and ignored groups. The name of each member was read, and in response the pupil came forward. Then the praised group was commended for its effort and achievement. When praised, it was also urged to do its best and improve its record. The same procedure was used for the reproved group. They were scolded for their carelessness, poor work, and failure to improve. The members of the ignored group were present in the room with the praised and scolded groups and listened to the treatment that each received. Nothing, however, was said to the group designated as the ignored group.

The results are given in Table XV.

TABLE XV.—AVERAGE SCORES MADE ON ARITHMETIC TESTS BY GROUPS WORKING UNDER DIFFERENT INCENTIVES FOR A PERIOD OF FIVE DAYS\*

| Groups         | First day | Second day | Third day | Fourth day | Fifth day |
|----------------|-----------|------------|-----------|------------|-----------|
| Control ... .. | 11.8      | 12.3       | 11.6      | 10.5       | 11.4      |
| Praised ... .. | 11.8      | 16.6       | 18.8      | 18.8       | 20.2      |
| Reproved.....  | 11.8      | 16.6       | 14.3      | 13.3       | 14.2      |
| Ignored. ....  | 11.8      | 14.2       | 13.3      | 12.9       | 12.4      |

\* After Hurlock, 1925.

The achievement of the control group, which worked by itself, remained on a level; it is surprising that it did not decline. Apparently, these pupils did their work with no increase or decrease in enthusiasm and effort. The ignored group showed a little improvement at first, but the effect of witnessing approval and disapproval apparently worked off.

It is a most interesting fact that the initial improvement of the praised and reproved is the same. The effects of scolding soon wear off, however, and there is a decline but not to a level below the initial score. In the case of the praised group, the trend is toward a slow but steadily increasing achievement after the first initial spurt.

These results show that praise is most effective, reproof is next, and being ignored in the presence of praise and reproof

results in a little better achievement than when pupils work by themselves with no particular stimulation of any kind.

Further analysis indicates that praise influences the poor students most and that reproof has an unfavorable effect on them. Reproof, on the other hand, may have a desirable effect on some of the brighter children, although on the whole praise is better. Poorer pupils need praise and encouragement, but the bright are so accustomed to "easy sailing" that reproof may spur them to better work.

The teacher needs to exercise discrimination in the use of praise and reproof and also to be selective in its application. Either one used in excess or in a perfunctory manner may cause it to be not only ineffective but even negative in its effects. An occasional scolding and reprimand may stimulate a desirable response; but if often repeated, they will lose their effectiveness. Praise is effective for a longer time, but it, too, may easily be overdone. Pupils also differ individually in their responsiveness to both commendation and disapproval. Thus, praise is best for one, and reproof for another. A few pupils are badly upset by unfavorable criticism; others are calloused to it. If the teacher studies her pupils carefully, she can discover their reactions to her criticism, favorable or unfavorable, and can treat them accordingly.

✓ **Knowledge of Results.**—According to some teachers' methods, the pupils hardly know how they are getting along. They are not certain if they are making progress; how they stand in relationship to the others in their class; or if their work is highly satisfactory, moderately satisfactory, or barely satisfactory. Report cards indicate a child's status in a general way, but they are issued only once a month or every six weeks. Furthermore, they are becoming less specific, indicating only approximately whether the work is satisfactory or unsatisfactory.

A common complaint of pupils is that their teachers do not return their papers. The students wish to have their written lessons and examinations marked and returned, so that, in addition to profiting from the corrections, they also will know to what degree they are successful. Students want a knowledge of results.

Graphs and records are kept of pupils' achievement in spelling, reading, arithmetic, athletic contests, and other school activities

so that they may know the results of their work. These charts are kept by the students or are posted in their classroom. They watch their curve and are motivated to improve. They have knowledge of their own progress and that of their fellow classmates; consequently, they work against their own record as well as that of their classmates.

**Objective Evidence on the Effect of Working with and without Knowledge of Results.**—A number of experiments have been conducted during the past 20 years to test achievement when students have a knowledge of results and when they have not. The results are consistent in showing that a knowledge of achievement or the scores obtained during the course of work operates positively to improve achievement. Grade-school, high-school, and college students have been subjects in the experiment, and the results are positive for learners of all degrees of maturity.

The scores in Table XVI indicate the achievement with and without motivation, when the material involved was English usage and the object was to find the errors in sentences ("We was on time" and others of that type)(7). The subjects were sixth-grade children in certain New York schools.

TABLE XVI.—GAINS OF NON-MOTIVATED AND MOTIVATED PUPILS IN ENGLISH USAGE\*

|                                        | Gains             |                  |                  |
|----------------------------------------|-------------------|------------------|------------------|
|                                        | Manhattan schools | Brooklyn schools | Weighted average |
| No motivation:                         |                   |                  |                  |
| One repetition.....                    | — .31             | +1.07            | .496             |
| Three repetitions .....                | + .86             | + .76            | .794             |
| Five repetitions . . . . .             | +2.09             | +1.33            | 1.540            |
| Ten repetitions....                    | +4 73             | +3 01            | 3.764            |
| Test motivation with three repetitions | +4.35             | +2.08            | 3.028            |

\* Adapted from Symonds and Chase, p. 31.

The motivation in this experiment consisted of the individual's trying to improve his own score because of a knowledge of the scores that he was making on the tests. In addition, he was given his standing in the class and also the standing of the class in comparison with other classes. Thus, he was working to

improve his own score, to outstrip his fellows, and also to improve the position of the class.

Three repetitions with motivation are not so effective as 10 without but decidedly more effective than 5 non-motivated repetitions. The data in Table XVI show that repetition or practice is effective; but when coupled with the motivation of improving known scores, practice is clearly more effective.

**Interest and Ability.**—Generally, when we begin a task, we must “drive” ourselves. When the work is difficult, which it usually is at first, we tend to turn away from it. Thus, when a student begins the study of a language, takes up the piano, or begins work in other fields, he finds the work rather distasteful at first. If he persists, however, and acquires competence, his attitude toward the work will change. Interest develops and stimulates activity, and thus it is again that “nothing succeeds like success.”

In the older psychologies, emphasis was placed on “striking while the iron was hot.” According to this theory, there were certain periods when children had various interests, and these periods should be capitalized on. The weakness in this psychology lies in the fact that there probably are no specific and definite periods when different interests burn brightly.

✓ Another point of view is that we should strike until the iron becomes hot. There may be little interest at first; but if we prod ourselves and develop ability, we become interested. ✓ Much that we do as regular routine—reading, typewriting, piano playing—was once hard, discouraging work; but when a certain degree of ability was attained, interest increased correspondingly. Thus it is with specialists in any field—medicine, law, chemistry, psychology—when they acquire competence, many features of their work become very fascinating. Thus, interest and drive are concomitants of acquired ability.

**Threat of Failure and Learning.**—Related to the problems of marking the pupils' achievement is the one of promotion. Ordinarily, when pupils had low marks, they were failed; and when their marks were satisfactory, they were promoted to the next grade. During recent years, there has been a definite trend toward lessening the number of failures; and in some schools, children are rarely, if ever, retained in a grade to repeat the work in which they have failed.

A question may be raised concerning the effect of this policy on the industry and achievement of the pupils. Some teachers insist that if the threat of failure is not held over school children, they will not work hard on their lessons, and that it is necessary to fail some in order to cause all to put forth their best efforts. Other teachers feel that students can be motivated in other ways and that many work even harder when they know that next year they will be in the next grade and have to do more difficult work.

The value of the threat of failure as a motive has been tested (8). Nine teachers, when teaching the students, warned them about the danger of failure and occasionally threatened them with that penalty. Nine other teachers in this experiment, however, made it clear to their students that there would be no failures and that everyone would pass. The awareness of the two groups of the policy that applied to them was adequately maintained but not overdone. The pupils in this experiment were of the second and fifth grades and were tested at the beginning of the semester and at the end, in order to check the effectiveness, of the policy of impending failure and of no failure on achievement.

✓ It was discovered that the difference in the achievement of the failure and non-failure groups was very small—probably inconsequential. If there was any superiority at all in achievement, it lay with the non-failure group. ✗ When analysis was made to determine the effect on students of different levels of intelligence, it was also discovered that there were very small and unimportant differences.

When the teachers were asked to indicate the reactions of the pupils, a few replied that some worked better when they knew that they were to be promoted; on the other hand, when some pupils felt that they would not pass, they developed the attitude "It's no use, anyhow!" Other teachers felt that some pupils slacked up when they knew that they would pass no matter how poor their work. Some teachers experienced no change, whereas others felt that conditions were improved, and others again felt that the classroom situation was poorer. Such wide diversity of opinion is more or less consistent with findings that indicate that a non-failure or a failure policy makes comparatively little difference in the actual classroom achievement of the pupils. ✗ The advantage of any policy on failure or no failure will probably

be found in its effect on the feelings and character of the pupils and will have to be tested over a long period of time in order to yield definite results.

**Desirable Characteristics of Incentives.**—An incentive should cause the student to focus his energies on the task at hand. This is usually accomplished if the goal is clearly in mind and if the learner feels a real need.

Thus, the goal should be within reach. Some students, for example, are not encouraged by the desire to be on the honor roll, because they know that they have no chance. Similarly with school marks; comparatively few are motivated by them, because many have given up aspiring for high ones. Incentives should be adjusted so that they encourage all students to work harder.

Motives and incentives vary according to sex, brightness or dullness, and age of the learner. Devices used in the kindergarten to stimulate the kindergarten children would only cause college students to smile. There are basic similarities in the recognition given the achievement of old and young, but the incentives for children are more apparent. Similarly, bright and dull children differ, for example, in their response to praise and blame. Still, all motivation that results in the learner's acquiring prestige or a feeling of worth is nearly always effective.

The motive or incentive is often made the end rather than the means. The consequence is that the attitude toward the tasks at hand is not in the form of deep-rooted interests. Instead, the students work for the prize, school mark, praise, or whatever the incentives happen to be. Thus, a student works for a high mark rather than competence in the subject. The purpose of incentives and motives is not to increase the effort devoted to incentives and motives themselves but to cause heightened interest in the tasks at hand.

In this connection, it may be added that good will ought to result from the use of incentives. If rivalry is used, does it result in sharp practices and hard feeling? Also, if prizes, such as medals, badges, gold stars, and certificates, are used to give distinction, do they lead to feelings of jealousy, selfishness, and excessive individualism? Incentives and motives should be evaluated not only as to their effect on achievement but also on the attitudes and emotions they evoke.



### VISUAL AIDS AND LEARNING

In some schoolroom situations, the efforts of the teacher are supplemented with visual aids. These aids, among others, take the form of slides, motion pictures, museum displays, maps, and models. Of special interest in this connection during recent years have been motion pictures, many of which are now accompanied by sound. There is hardly a large school system that does not make use of motion pictures in the classroom.

As is true of all new teaching devices and techniques, visual aids are tested to determine the extent to which they facilitate learning. In the old psychologies, stress was laid on teaching through all the senses, and evidence even appeared to the effect that some learners were eye-minded, whereas others were ear-minded, and some learned primarily through the sense of touch. Subsequent research, however, indicated that learners could not be classified definitely in this way. As a consequence, emphasis has been placed on teaching through all the senses by means of rich and varied experiences.

The motion picture teaches through the eye and now, with sound, through the ear also. It is said of motion pictures that they give children the dynamic relationship of things and a clear visualization of the concrete and objective instead of indefinite mental pictures produced by meaningless verbalisms.

**Learning Geography and General Science with and without Films.**—Still, no one could know clearly the values of motion pictures until they were tested, and this has been done in a number of instances. Over 10 years ago, an experiment was conducted to test the value of motion pictures in geography and general science(9). About 7,500 children in the geography class and 3,500 in general science with nearly 200 teachers in 12 cities were included in the experiment, which extended over a half year's time, or a school semester. The films in geography dealt with such topics as New England fisheries, wheat, cotton growing, and iron. Those in general science were on atmospheric pressure, water supply, sand and clay, and reforestation.

In about one-half the classes, films were not used in teaching the various topics covered during the semester of the experiment, whereas in the other half, they were used. Tests were given at the beginning and end of the experiment in order to discover

the gains made; comparison of the two groups indicated the effectiveness of the motion-picture films. All the teachers were given the same outlines and covered the same topics in their teaching. Some of the tests used were objective in nature, and a modified form of the traditional essay examination was also used.

The purpose of the testing was to determine the knowledge gained by the pupils from instruction and also to test their ability to reason and think with the knowledge that they had obtained. In the comprehensive, or objective, test, the experimental group gained more than did the control, indicating that the motion pictures were effective. The gains were not much larger, but of most significance was the fact that the group taught by help of films was consistently superior. This consistent superiority in the differences is probably more important, for the time being, than the amount of superiority.

In the topical, or essay, tests, the results corresponded to those obtained with objective, or true-false, multiple choice, tests. The difference in general science was equivalent to 23.2 per cent of the standard deviation of the scores and in geography to 29.3 per cent of the standard deviation. The superiority of the group taught by the use of films was found in 9 of the 12 cities and, in the case of geography, in all 12 cities.

In addition, the teachers were asked various questions by means of questionnaires, and most of them replied that the films had proved effective. From both the testimony of teachers and the experimental evidence, it is safe to conclude that learning is definitely improved by the use of films in the classroom.

**Visual Aids and Learning Latin.**—The use of visual aids also resulted in improvement in Latin(10). Two small groups of students had the same teacher and the same textbook and, as far as possible, were taught in the same way, except that one group was taught also by the help of stereopticon pictures. By means of these, objects were depicted on the board, and the Latin words associated with them were also presented. In short, objects and their Latin names were shown; when the pictures were removed from the board, the words remained, and the students were questioned about them. Slides were used extensively to present words and sentences in order to teach them to the students.

The control group was taught in the same way as the experimental but without the help of stereopticon pictures. The

results were clearly in favor of the group whose teaching had been supplemented by visual aids, which in this instance were comparatively simple. Over a period of less than a month, the experimental group gained 113.7 words, but the control group gained only 93.9. In addition, the number of errors in English translation were 10.2 and 23.2 for the experimental and control groups, respectively. Those who were taught by visual aids also made fewer errors in grammar and were much more attentive. Thus, over a comparatively short time, the visual aids proved their effectiveness.

**Other Results from Visual Aids.**—In Pittsburgh, two experiments were conducted to test the value of visual aids in the teaching of fifth-grade geography. It was discovered that motion-picture films increased learning of information by about  $14\frac{1}{2}$  per cent more than with the use of lantern slides, still films, and stereographs alone and that the use of all these visual aids increased the acquisition of information about 23 per cent more than when no such visual aids were used.

Most results are consistent in showing that visual aids increase the amount that pupils learn. Knowlton and Tilton studied the effect of the use of *Chronicles of America Photoplays* in teaching junior high-school pupils(11). Ten photoplays were used; on the average, the gains were about 25 per cent more; the amount retained after three months was about 27 per cent more. Tests designed to measure the interaction of events and forces showed an increased learning of 35 per cent, and the knowledge of historical personages showed an increase of 23 per cent.

Other experiments have been conducted, and all are practically unanimous in showing the great values of motion pictures, slides, illustrations, and various other forms of visual aids. Good teaching can be achieved by varied and vivid presentation, and learning can be improved materially by extensive use of these devices.

#### SUMMARY

Various incentives, motives, and factors that stimulate achievement are the following: praise (encouragement), reproof (discouragement), knowledge of results, examinations, school marks, honor rolls, acquisition of ability, prizes, rivalry, cooperation, working alone, and working in a group. On the whole, all these

stimulate achievement to some extent, but some more than others. Praise is more effective than blame and more effective with the less bright and the younger children. Altogether, praise is positive and is effective over a longer period than is blame. Knowledge of results is consistently a good influence for all students regardless of age, sex, or degree of brightness. Students work hard to obtain prizes, and rivalry stimulates them to beat their fellows in order to obtain a high ranking. Merely from the standpoint of achievement when working for oneself, most students strive harder than they do when they work for the group. Some work is done better alone, and other work is done better in the presence of the group.

In general, it may be concluded that any incentive that gives the student a goal or purpose for working and intensifies his interest causes an increase in achievement. By and large, the positive influences such as praise are better than the negative such as scolding. Not all experiments are consistent on all these matters, but the points made in this summary represent the most widely accepted findings.

#### Problems and Exercises

1. List the methods used by your high school or college that fall within the scope of this chapter.
2. What are the methods used by your favorite teacher to interest and motivate the pupils?
3. Give some examples of how comparatively distasteful tasks became interesting because ability was developed through practice.
4. What situations have you observed where rivalry and competition have had bad effects?
5. In what type of activity, or in what specific activity, do you think the efficiency is greatest when one works alone? What type when in a group?
6. What can be done in school and out of school so that one has knowledge of his progress?

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## CHAPTER XV

### FATIGUE, DRUGS, ATMOSPHERIC CONDITIONS, AND LEARNING

**Directions for Study.**—Be able to trace the mental efficiency of school children throughout the course of the school day.

On the basis of our knowledge of mental fatigue, how should the various school subjects be scheduled?

Differentiate between fatigue in an experimental and test situation and in the usual schoolroom situation.

Observe the effect of variety in work on mental efficiency.

What effect does a sleepless period of 60 to 70 hours have on mental and physical abilities?

Differentiate between feelings of fatigue and actual fatigue, and note the relationship between them.

Note the large number of conditions, or factors, that tend to induce fatigue.

The effect of tobacco, alcohol, caffeine, strychnine, and "pep pills" on the power to respond in various situations is not the same. Study the effects, and make comparisons.

How do temperature and humidity influence learning?

#### CONTINUED MENTAL EFFORT AND EFFICIENCY, MENTAL FATIGUE

Can a pupil learn as well at the end of a day as he can at its beginning? Does the school child become so mentally fatigued from doing his lessons that he is unable to do his work as well in the afternoon as in the morning? These questions pertain to mental fatigue and its effect on learning ability.

From a practical point of view, there is no mental fatigue. Children have been tested at different times of the school day to discover their power to repeat digits,<sup>1</sup> multiply, add, read, insert

<sup>1</sup> The test of power to repeat digits is commonly referred to as a *test of digit span*. Numbers, or digits, such as 4, 2, 9, 7 are presented either orally, when the examiner reads them at a regular rate of usually one digit

the missing words in incomplete sentences, and do other tests of mental efficiency. The results indicate that abilities fluctuate very little throughout the school day. On the average, children are as capable of doing mental work at three o'clock in the afternoon as they are at nine o'clock in the morning. If anything, there is a slight tendency to be better in hours other than the first hour of the day. The differences are so slight that it is probably most accurate to conclude that during the school day the mental and learning abilities show no material decline or fluctuation because of mental fatigue.

Even though pupils do not become mentally fatigued during the school hours, still they may feel tired. A feeling of fatigue may cause them to be less efficient, unless the circumstances of the schoolroom cause them to work at top speed. Any decrease in performance during the school day is caused not by a reduction of actual capacity but by lagging interest, restlessness, and a feeling of being tired. Sitting in a seat for several hours causes some muscles to become tired, and the pupil often gets bored by the monotony of the situation.

With the passing of the day, a mind-set develops for the after-school activities, and consequently the pupil concentrates less on his lessons. Thus, in a practical sense, the teacher does have to contend with decreasing efficiency on the part of her pupils. They can do as well at the end of the school day as at its beginning; but in the typical schoolroom, she finds it harder as dismissal time nears to interest them and to maintain her own alertness and interest. Neither teacher nor pupils feel so able as earlier in the day; consequently, their general behavior shows it. If the latter were placed in a test situation, they would do about as well as at any other time of the day; but the usual control during the school-day routine is not so rigorous as that of a test situation. Consequently, the children are apt to slump toward the end of the school day. The teacher's problem is a practical one. It consists of arranging her program so that the pupils and she will work more zealously when it seems harder to concentrate.

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a second, or visually, when they are presented for a short period. By means of digit-span test, it may be discovered how many digits a subject can repeat without error. Three-year-old children can usually repeat on the average three digits; ten-year-olds, six digits; and superior adults, nine.

Various investigations of efficiency throughout the school day generally consist of testing the ability of school children with arithmetic tests, tests of memory, and other tests. The general course of ability is one that shows an increase from the beginning of the school day until noon. No fatigue should manifest itself during the morning; in fact, there is a tendency for efficiency to increase slightly during the course of the morning.

The facts hardly warrant charting a precise course of efficiency. It may safely be said that actual fatigue is not an important factor and that efficiency does not decline an important amount throughout the school day. Even though there is a slight decline of pupils' ability in the afternoon, the problem, apparently, is one involved not in their actual efficiency but in the feelings of the pupils toward their work.

The first and last hours of the school day are not the most efficient. During the first two hours of the day there is an improvement in efficiency which reaches a level quite uniformly maintained until the last hour, when a decline sets in. The improvement at the beginning of the school day is probably the result of "warming up," and the drop at the end is due in part to fatigue and also to the letup that usually accompanies an anticipation of the end of the school day. For younger children, continued mental effort over the length of the school day is known to result in a true and considerable decline in the ability to sustain it.

Figure 18 shows the curve of ability to add(1). The rise in the curve indicates a more rapid increase than is actually the case, because the curve does not begin at zero but at approximately 77. In general, then, most findings agree with those indicated in Fig. 18, showing that the periods of greatest output are between the end periods.

**School Subjects and Hours of Day.**—The investigations of mental fatigue have demonstrated that some school subjects need not be scheduled for the beginning of the school day because they are more fatiguing than others. A common belief has existed among teachers that arithmetic, for example, should be scheduled for the beginning of the school day because it should be studied while the children are fresh. It has also been recommended that other subjects, such as reading, grammar, history, and geography, should be placed at the beginning of the day's



schedule. There is no need of differentiating the subjects on that particular basis, because the pupils are essentially as able to learn at one time of the day as at another.

In one school, for example, it proved desirable to teach arithmetic the last hour of the school day. The teacher explained to her superintendent that she had difficulty in maintaining the interest of her pupils during the last hour of the afternoon. She was teaching history during this period, and she complained that

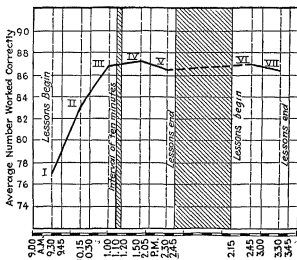


FIG. 18.—Changes of lessons are shown by continuous lines, and times of testing by interrupted vertical lines. (After Stainer, 1929.)

the pupils were restless and inattentive. The superintendent recommended that she teach history, which called for little activity as it was being taught, the first part of the day and have arithmetic the last hour. The teacher thought that arithmetic was too "hard" a subject for the last hour of the day. She was told that subjects differed little in that respect and that she should try it. It worked out splendidly. The activity that the arithmetic called forth overcame the boredom and listlessness apparent in a class where the pupils had been much less active. The pupils worked with pencils and paper at their seats; they were active at the blackboard; and short drills and exercises also maintained their attention.

Actual mental fatigue could be induced during the span of the school day if it were attempted. It would of course be foolish to do so; but if the pupils had to work at one type of task, such as solving arithmetic problems, memorizing poetry, learning the meaning of words, or writing compositions all day, they would not be so capable at dismissal time as at the beginning of the school day. A small decrease in these abilities may set in by the end of the morning; but immediately after the noon hour, the pupils would be nearly as good as ever; however, before the school day was over, decline that could be attributed to actual fatigue would set in again. True, or actual, fatigue is avoided by varying the school program; practical fatigue, boredom, or loss of interest, can also be prevented to a large extent by avoiding monotony. Recesses occur in the middle of morning and afternoon sessions; drawing, shop work, and gymnasium are scheduled between academic subjects to relieve the strain and loss of interest that develop from continued application for long periods to similar kinds of school work. It is important that the schoolwork be judiciously varied and balanced so that interest can be more easily maintained during the school day. Even though actual mental fatigue does not set in during two to four hours of mental work to impair mental power materially, the interest in the work that is being done goes down considerably. A person can translate French, mark papers, memorize geography facts for a period of two or three hours with a loss of efficiency less than 10 per cent, but his feelings of zeal and enthusiasm for the work he is doing decrease materially during that period. The practical problem for teachers who direct learning and for those learners who have control of their own time is to vary their tasks as far as possible in order to maintain maximum interest. The problem is fundamentally one of interest rather than of fatigue.

The effect on mental efficiency of three hours of work involving reading, defining words, detecting word relationships, and working arithmetic problems has also been tested by measuring efficiency before and after the long period. College students have been found as capable at the end as at the beginning(2).

Instead of giving a test before and after a long period of mental work, efficiency may be checked by changing the order of the tests so that various groups will take a given test at the beginning

and others will take it at the end of the period. If a decrease in ability occurs, because of mental fatigue, a comparison of the scores will show that the scores for the test taken last are smaller. Several thousand adults were tested between 8:00 and 10:00 P.M., and a comparison of the scores of the various groups taking the test first with those taking it last showed that ability in a mental-test situation was just as high at the end of that period as at the beginning.<sup>1</sup> Most of these adults were professional and semi-professional people whose work may be described as mental in nature; but still, at the end of a 2-hour testing period comparatively late in the evening, they were just as capable as ever.

In another situation, however, efficiency might decline. If, for example, students listen to an ordinary lecture from eight to ten in the evening, their attention probably will wander a good deal, particularly during the last hour. A few may even fall asleep; and only a comparatively few will pay active attention. In a test situation, however, students are equally capable throughout a long period of two or three hours. Unless the situation calls forth the complete attention and power of individuals, as does a test or examination, a group of children or adults is apt to behave as if fatigued during a class period, lecture, sermon, or other situation where they are passive.

A theory has been advanced, for which there is some experimental evidence, that the mind protects itself by operating in short cycles interspersed with short rest periods(3). Thus, if a child is working arithmetic problems, his attention is released periodically. These cycles of work with short rest periods tend to keep the mind efficient over a long period. This is advanced not as an established fact but as a partly substantiated theory which may explain why the mind maintains its efficiency so well over a comparatively long period.

Yet even though the mind does not become truly fatigued during the usual school day, the conclusion should not be drawn that mental fatigue is not a reality. It is an actual condition but is brought about only by severe and sustained mental work. This fact was demonstrated by Miss Arai, who multiplied four-place numbers by four-place numbers mentally for periods of 11 hours during several days(4). She would first memorize the numbers, such as 8,743 and 5,964, and then proceeded to find

<sup>1</sup> Based on unpublished researches by the author.

their product. She did the multiplication mentally. After 11 hours, it took her about twice as long to get the answer, and also the amount of error increased slightly. In other words, at the end of 11 hours, her efficiency was about 50 per cent of what it was at the beginning of the period.

At the end of her 11-hour periods of mental multiplication, Miss Arai memorized 40 German words. The significant fact brought out in connection with this was that the loss of efficiency in learning German because of 11 hours of multiplication was only one-fourth as great as the loss of efficiency in the multiplication itself. This fact indicates that when fatigue has set in for a given task, if the subject changes to another task, the efficiency for the latter will be greater than for the former. Again, it seems that variety or a change of activity prevents to a large degree loss of efficiency because of mental fatigue.

In connection with the problem of fatigue, the age factor should be considered. The younger students cannot concentrate so effectively on formal schoolwork for as long periods as can the older ones. Types of tasks that require systematic study are not so fatiguing to upper grade, high-school, and college students as they are to preschool and lower grade pupils. Consequently, the work for beginners should be less formal and consist to a greater extent of activities and projects that capitalize on the natural tendency of the children to be physically active.

**Feeling and Efficiency.**—The relationship between feeling and efficiency shows that efficiency in some tasks increases, whereas feeling about the work declines in the direction of being tired. The scale of feeling included seven degrees: (1) extremely good, (2) very good, (3) good, (4) medium, (5) tired, (6) very tired, (7) extremely tired. Four different tasks were performed, each for about  $5\frac{1}{2}$  hours. They consisted of the addition of two-place numbers, sentence completion, rating compositions according to a scale, and intelligence tests. In the addition test, each subject using one of the terms given reported how he felt at the end of each 30 minutes of work. In the test of ability to fill in the missing parts of a sentence, the subjects reported individually on how they felt every 21 minutes; at the end of every 10 compositions rated and at the end of each 21 minutes, in the case of the intelligence tests, the subjects described their feelings as being extremely good, very good, good, etc., as given above.

Figure 19 shows the relationship between feeling of fatigue and actual, or true, fatigue(5). The solid line representing actual achievement reflects the course of actual fatigue over the work period of about 5½ hours; the dotted line indicates the feeling of the worker toward the task.

In all the tasks, the feeling of fatigue is more pronounced than the actual fatigue. Thus, even though a subject is becom-

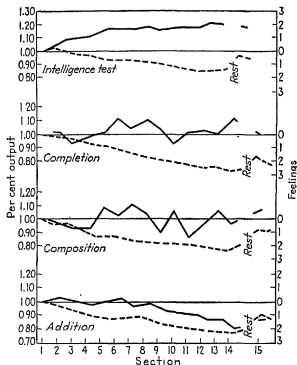


FIG. 19.—Relation between output and feelings in four forms of mental work. Solid line represents output, and dotted line represents feeling record. (After A. T. Poffenburger, *Journal of Applied Psychology*, 12: 459-467, 1928.)

ing increasingly tired of the work, his efficiency can still be maintained and possibly even be increased, as in the case of the subjects taking the intelligence test.

The relationship between the curves for performance in the addition of two-place numbers and the feeling for that task is different from the rest in that they parallel each other more closely and also because efficiency reaches a point almost as low as the feeling

for the work. Possibly in the simpler, more monotonous, and routine tasks, the actual output follows feeling for the work more closely than it does in the performance of tasks and functions that are more diversified and complicated. Thus, one will maintain efficiency in the functions employing the higher mental processes but not in the simpler functions, even though the feeling for the simpler and less varied tasks takes about the same course as does the feeling for tasks involving a higher order of response.

In connection with the rest periods, it may be observed that the feeling toward the work is changed more than is actual performance itself. Rest improves the feeling toward the work but has little effect on the work itself, and this is to be expected, as there is no actual fatigue but only an attitude of fatigue. One's feeling toward his work is very important, and rest periods probably are most important because of their psychological effects. They improve the feeling for work.

**Loss of Sleep and Mental Efficiency.**—Teachers at times complain that some of their pupils are too sleepy in class to learn as much as they might. They accuse the parents of permitting the children to stay up so late at night that schoolwork suffers the next day, and they maintain that students lose efficiency when they lose sleep.

Experiments have been made that help to answer questions concerning loss of sleep and efficiency(6, 7). They have demonstrated the effects of loss of sleep on mental ability, strength of grip, speed of tapping, and ability to aim a gun accurately. In several experiments, the sleepless periods were from 60 to 70 hours long. The length of such periods can be appreciated when we realize that ordinarily the maximum period that a person goes without sleep is about 20 hours; such a period of sleeplessness generally means that going to bed is postponed until three or four in the morning. Even at the end of 20 hours, a person feels very sleepy and tired.

The general results of experiments on sleeplessness indicate that after one sleepless night, there is hardly any decline at all. The abilities measured by intelligence tests, for instance, are just as high after a night without sleep as before. That statement is true of practically all abilities. In this connection, however, the factor of effort must be recognized. In the experimental situation, those who were deprived of sleep keyed

themselves to maximum effort and thus overcame the effect of sleeplessness. In the ordinary circumstances of the classroom, home, or office, children and adults would be more likely to yield to their drowsiness.

Toward the end of the 60- to 70-hour periods of sleeplessness, a definite decline in mental efficiency was apparent. The time required for doing a task increased, and errors were more frequent. Most of the loss occurred toward the end of the period. In addition, the subjects developed nervousness, headaches, dazed condition, and disturbance of speech. Evidently, up to a certain point, a loss of sleep may even act as a stimulant, but prolonged sleeplessness exacts a heavy penalty.

Complete recovery of mental power, which is lost because of a long period of sleeplessness, is brought about by a normal period of sleep. An 8- or 10-hour sleep following the long period without sleep restores mental powers to normal. It is altogether possible, however, that exhaustion due to inadequate sleep over an extended period of weeks or months would not yield so readily to the resumption of a normal routine. There is no psychological evidence against a program of living that provides for reasonably regular and substantial periods of sleep.

Prolonged sleeplessness causes actual fatigue, it is true, but we should not interpret a feeling of sleepiness as necessarily indicating actual fatigue. We may occasionally feel sleepy and tired without having our actual efficiency impaired. If, when sleepiness and fatigue seem to overtake us, we eagerly attack a problem, we shall be as efficient as ever for a few hours at least. It is customary for us to identify the feeling of not desiring to work with diminished capacity for work, but the two are often different. At times, we may be actually fatigued mentally without being clearly aware of our condition. Our feelings of tiredness are not a reliable index to our actual state of mental efficiency.

Both mental and physical work, if prolonged, appear to bring out reserves of energy. We may feel tired, but renewed effort results in continued efficiency for a long time after the initial feelings of fatigue set in. If, therefore, a pupil is to develop his powers, he should not stop studying as soon as he feels fatigued. By continuing beyond that point, he trains himself to study for longer periods. The psychology of fatigue indicates

that, when a loss of interest, boredom, or feeling of tiredness set in, we still have reserves of energy that have not been tapped. To experience mild fatigue is good training, as it conditions one for harder work. Acute weariness, however, should be avoided, for it conditions one to avoid the work that causes it. If one experiences the emotions that accompany too severe fatigue, he may develop a distaste for mental work. Some students are conditioned against study because at some time they have felt very tired and distressed from having worked too hard. The mild fatigue induced by sustained mental effort, however, trains a student for harder levels of work by developing his ability to concentrate and to ignore minor discomforts.

**Sleep and Age.**—Sleep is an important factor in mental efficiency, but it is difficult to fix standards, or norms, of the amount needed by children of various ages, because children differ in their individual requirements. As a general guide, the following may be given. Children six to twelve years old require, on the average, about 11 to 10 hours; children twelve to fifteen, about 10 to 9 hours; and persons from fifteen to adulthood, 9 to 8 hours, the amount varying inversely with age. Some may require a little more than the amount indicated in order to avoid tiredness; and for some, the normal amount is less. Careful observation of the general condition of a child will reveal what for him are the best bedtime and rising time.

**Physical Condition and Fatigue.**—A child or adult becomes tired because continued work exhausts the energy supply and causes toxins, or fatigue products, to be formed. We are not certain how mental work consumes energy and causes fatigue products. It is the common opinion, however, that thinking requires very little energy. Still, the fact must not be overlooked that mental work does not involve the nervous system alone but to some extent the whole body. The senses are used intensively, the eyes making hundreds and thousands of movements, and the muscles must support the body generally in a sitting posture. Fatigue is certain to develop.

Fatigue is caused by physical work, because the activity of the muscles produces chemical products, or toxins, that reduce efficiency. These organic poisons—this tissue waste—resulting from use of the muscles, produce feelings of as well as actual fatigue. It is believed that muscular, or body, fatigue causes



mental fatigue also, or that the two are not entirely distinct and separate.

A nerve is difficult to fatigue. It can be stimulated again and again, but its efficiency decreases very little. Furthermore, no researches have established as definitely the fatigue poison resulting from the activity of nerve tissues as has been found from muscular work. Possibly, fatigue poisons affect the connections of the nerves or the synapses and thus reduce mental efficiency. Sight should not be lost, however, of efficiency in terms of both muscular and mental fatigue, and the two should not be regarded as being independent of each other. If fatigue is interpreted narrowly in terms of limited nerve stimulation, one may overlook its wider significance in terms of physical and mental health. We know that mental and physical activity do produce fatigue and, if prolonged without adequate rest and recreation, may result in a state of nervousness and ill health that will cause a low state of efficiency for a long time.

The continued use of the eyes induces fatigue; and if the illumination is inadequate, too strong, too weak, or too glary, fatigue is developed much more quickly. Consequently, the illumination of classrooms, laboratories, and libraries needs to be governed to protect the students. Good translucent shades, plenty of windows, well-arranged artificial lighting will provide adequate light. Not enough light is a serious condition, but the wrong light, such as direct sunlight or reflection from shiny surfaces, also induces eyestrain and consequent headaches. With the aid of a light meter, the amount of light can be tested, and adequacy can be determined by comparison with standards.

Then, too, a child tires easily and becomes restless if kept in the same position for a comparatively long period. The restlessness of a child, or the continual shifting of position, is an attempt to distribute the stress to various muscles and thus to reduce the amount of postural fatigue. Sitting, standing, and even lying in the same position induces fatigue in a short time because of the strain put on certain muscles.

Noise causes impact on the nervous system through the ears as light stimulates through the eyes. Noise, too, causes fatigue. Noises in the school building from machinery, the gymnasium, the music department, the hallways, and even the classrooms themselves contribute to pupils' fatigue. Schoolhouses are

often situated where the loud and drumming sounds of the traffic—streetcars, busses, trucks, and automobiles—bear down on the pupils and teachers in the schoolrooms. Noises are often distractions; and even if the pupils get used to them, they are still objectionable; on the other hand, it is not necessary to work for gravelike silence. Most healthful of all is the hum of a busy room, not necessarily because the hum is desirable but because it is symptomatic of a healthful condition.

Various factors producing fatigue can be summarized here. Some of them are internal, such as teeth, tonsils, defective eyes, nutritional status, and inadequate sleep. If the teeth are in poor condition, the tonsils inflamed and diseased, the eyes strained, the body poorly nourished and insufficiently rested, the child or adult is almost certain to be low in energy, easily tired, and unable to concentrate on the tasks before him. A good program of health and physical education will achieve much to maintain a child in such good physical condition that fatigue will not be easily induced.

External factors that induce fatigue are overstimulation, unhealthful clothing, inadequate ventilation, poor illumination, excessive noise, poorly adjusted seats, and even poorly adjusted schoolwork. If pupils from the kindergarten through college are engaged in too many tasks and activities, schoolwork, parties, dramatics, and athletic contests, they will be overstimulated; and if the schoolwork is either too hard or too easy for the pupils, a fatigued condition will also be induced. Thus, sharp glary light or light that is too strong or too weak; excessive noises; excessive temperatures or poor air; desks, chairs, and tables that cause poor bodily position; tight and inadequate clothing are decidedly unhealthful in their effects and cause children to tire more rapidly than they would under healthful circumstances.

Breakdown attributed to overwork and fatigue is more often the result of fear, worry, repressions, and other tensions. Often associated with the poor mental health that brings about disorganization or breakdown are poor digestion, diseased tonsils, malfunction of the endocrine glands, and other forms of organic deficiency. Work continued for some time with the knowledge that certain standards of achievement must be met and with a limit set for its completion induces fear and worry. Certain emotional states are natural concomitants of some work

situations. When the student is working hard toward the end of the course to avoid failing, when the graduate student is hurrying to complete his thesis, when the housewife is preparing a big dinner, the circumstances of the situations induce feelings and emotions that cause more wear and tear than the physical and mental fatigue induced by the work.

Many of the ill effects from work can be avoided by managing it correctly. The teacher can plan it, make her assignments, and guide her children so that they do their work systematically and with a minimum of stress and strain. The tasks can be well distributed; drill periods should be short and interesting; and the accumulation of tasks toward the end of the term can be prevented if the inordinate stress on examination and marks is replaced with an interest in the hygiene of the school and the health of the child. If these things are done, fatigue in its broader sense may be avoided. A child or adult, happy and content with his work, can expend an unusual amount of effort without being tired by his work or tired of it. However, when continued application causes overconcern, worry, and other tensions, the work should be left until one can approach it again with zest.

On the basis of the studies made of mental fatigue, it is easy to draw the conclusion that in a practical sense there is no mental fatigue. Consequently, a tendency may arise to generalize that fatigue is not a factor in the lives of school children about which teachers and parents need be concerned. Such a generalization is too narrow, as it may cause the parents and teachers to overlook the problem of fatigue in its wider sense.

Fatigue can hardly be restricted to that induced by mental activity alone, as fatigue is the product of mental and physical work, emotional stresses and strains, poor health, malnutrition, and other factors.

Many pupils are fatigued in the wider sense; and the teacher, if alert, can note the symptoms of a tired child. If a child seems weary and lifeless, stands and sits with poor posture, and complains of being tired, he should be carefully observed and studied. Also, if he displays considerably less than an average amount of energy and seems to be poorly balanced emotionally, he is manifesting symptoms of fatigue. When the symptoms have been discovered, their causes should be sought.

Fatigue results from various causes. Possibly as important as any are nutritional factors. Many children do not get enough to eat; some get the wrong foods; others eat irregularly and have other bad food habits. Because of the low standard of living enforced on so many families, undernourishment causes many pupils to be tired and listless.

If schoolrooms are poorly ventilated, overheated, and improperly lighted, fatigue may be induced. The air should be reasonably fresh; care should be exercised to keep the room temperature in the low seventies; and the light should be adequate, not too much or too little, and it should not be shiny or glary.

If a child is poorly adjusted to schoolwork because he does not have ability enough for it or because the teacher is too severe a taskmaster, he may react by being tired, or "lackadaisical," as the teachers are inclined to call it. Furthermore, if he is overstimulated by too much activity and too many sensory impacts in the form of music, noise, motion pictures, etc., he may also become fatigued. Understimulation, too, may cause a pupil to be apathetic. He may become tired of just sitting.

In general, a pupil's work should be planned so that his habits of working, sleeping, and eating become wholesome. A good balance can be struck among work, rest, and recreation; and by sensitiveness to her children's physical condition, the teacher may be able to detect conditions that are causing them to seem tired, apathetic, and lethargic.

#### THE EFFECT OF DRUGS ON MENTAL EFFICIENCY

Are there any harmless drugs or stimulants that increase a person's learning power? This is a pertinent question, as some students and people in general have the habit of taking certain drinks and sometimes drugs because they feel that they are stimulated by them. Drinkers of tea and coffee, which contain caffeine, feel more alert after a cup or two. Many habitually go to the soda fountain to be refreshed by drinks that contain caffeine. Some men and women drink whisky, wine, or beer in order to be stimulated mentally and physically.

Tobacco companies advertise the therapeutic value of tobacco that gives one "a lift." Some mental workers have taken drugs in order to maintain their efficiency over longer periods. In

the attempts of some people to maintain and increase their mental and physical alertness, drugs play an important part.

Obviously, a discussion of drugs in a book on educational psychology will lay the greatest emphasis on their effect on learning ability. Their effect on health may be of much greater importance; and even though their effect on learning ability is emphasized, the reader should not be shunted away from a consideration of the effect of their continued use on general health. If drugs do injure the health, then, of course, they impair mental and physical efficiency. Most of the studies of drugs and efficiency have been conducted over a relatively short period of time; possibly the effects would be much increased over the span of a lifetime.

**Tobacco and Mental Efficiency.**—A number of studies have revealed that boys who smoke obtain lower marks in their subjects than do boys who do not smoke. Non-smokers, on the average, are better students than are smokers. This fact has been interpreted as indicating that smoking affects the interest and learning capacity of boys so much that their scholarship suffers appreciably. Such an interpretation would be justifiable if the smoker and non-smoker were the same in every respect except for the smoking. Such is not the case, however. The facts are that schoolboys who are non-smokers have, in the main, higher I.Q.'s, come from better homes, and show fewer behavior-problem tendencies. The smokers and non-smokers are different in traits and characteristics that influence scholarship, so that the difference in school achievement cannot be attributed to the use of tobacco. It just happens that the pupils who smoke are those who have the least aptitude for schoolwork. Such has been the case in the past; but if more schoolboys take up smoking, the difference will be less marked.

Conceivably, smoking may have some effect on the learning ability of school children, but we cannot conclude that this is the case from the findings that smokers and non-smokers differ in their scholarship. The effect of tobacco on learning ability can be determined experimentally by testing the mental efficiency of persons during the periods when they smoke and when they do not or, better yet, by measuring the achievement of two equal groups of which the members of one group smoke whereas the members of the other do not. In the experiment, all factors

that influence learning ability must be the same, and the only variable, or differing, factor must be the smoking.

Studies that have been made to measure the effect of tobacco alone indicate that smoking does have a slight tendency to reduce mental efficiency. Not all who smoke manifest such a reduction, but the general trend is slightly downward. The physiological effects are more pronounced than the mental effects. The heart-beat is stimulated; steadiness is decreased; and the powers of motor coordination are weakened.

Evidence indicates that smoking has an effect on mental and physical efficiency. We are fairly certain that it does not improve them. Still, anyone who associates the use of tobacco with intellectual bankruptcy has a distorted point of view. Everyday observation shows that great mental work is being done by men who are habitual smokers and, in some cases, heavy smokers. Some of the most capable college students are smokers, while some of the poorest are not. The use of tobacco cannot reduce mental efficiency materially, or we should not see so many smokers among the great scientists and authors.

Most experiments of this sort have included adults as subjects. Probably the effect on growing children would be greater. The use of tobacco has been interpreted in terms of its influence on mental efficiency. In appraising it fully, it should also be evaluated for its effect on health; as an expense; as pleasure or annoyance; and also as a time-consuming, smelly, and uncleanly habit. These points are outside the present study but are mentioned in order to suggest a wider orientation to this and other problems.

**Alcohol.**—We need no experiment to provide data on what large dosages of alcohol do to mental and physical efficiency. Almost everyone has heard the incoherent words of a person who has drunk heavily or has seen such a person stagger about or lie on the floor. The evidence is fairly clear that in cases of intoxication, mental and physical abilities are seriously impaired.

Even though larger amounts of alcohol deaden and anesthetize the senses, it is conceivable that small amounts may stimulate the human organism and improve the facility with which it learns. There are those who insist that even a little alcoholic drink reduces the mental and physical powers; others maintain that moderate and restricted drinking improves the abilities to respond to a situation. The only satisfactory answer to the question is to be found in carefully conducted experiments.

One such experiment will be discussed(8). Tests of mental ability included multiplying two-place numbers by each other, finding the opposites of a list of adjectives, and learning to make substitutions involving letters and geometrical forms. Steadiness was measured by testing the ability to hold a small steel pointer in a hole without touching its edge. Coordination was measured by persons' being tested having to make contact with the metal inserts in a wooden triangle; those who could go around the triangle most often by making contact at each corner were considered as having greater powers of coordination. In a tapping test, the subjects tapped a metal plate with a metal pointer as fast as they could, and the number of taps were recorded electrically.

The young men who were subjects in this experiment were examined by these tests under a number of circumstances: when they did no drinking, when they drank a considerable amount of water, when they drank beer that contained no alcohol, when they drank about three bottles of 2.75 beer, when they drank six to nine bottles of 2.75 beer, and when they ate a heavy noon meal. They were in the laboratory a number of days from nine o'clock to four. The drinking or eating was done at noon, and the record on the tests during the morning was compared with the afternoon's record in order to test the effect of alcohol on mental ability, steadiness, and coordination.

The results indicated that efficiency was decreased by the alcohol. The decrease was largest during those afternoons following the heaviest drinking, being about 10 to 15 per cent for the mental functions; and the loss was only about 5 to 10 per cent during the afternoon following the noon of light drinking. The greatest effect was on steadiness; there was considerable unsteadiness when much beer was drunk. The losses of ability measured by the coordination and tapping tests were essentially the same as the losses in the mental functions and corresponded to the amount of alcohol consumed. It is rather difficult to interpret percentages psychologically; but, in general, it may be concluded that the drinking of comparatively weak beer lowered mental and physical efficiency a little; furthermore, as the amount of alcohol consumed was increased, mental and physical efficiency was further decreased.

Some of the more specific results of the experiment were that toward the end of the afternoon period, which ended at 4 P.M.,

efficiency was being regained because the effect of the alcohol was wearing off. It was also discovered that individual resistance to the effects of alcohol varied according to abilities. In general, those of the highest mental and physical capacity were influenced least by the alcohol, and those least capable were affected most. This is consistent with the general principle that good influences favor most those who are best and favor least those who are poorest originally; or that unfavorable influences affect less the most favored and most those who are least endowed. Another observation made in connection with the Hollingworth study noted that efficiency may be maintained quite well if the subject is highly motivated or fights off the effects that lower it. In other words, if one does not "let go," the injurious effects are much less. This principle also applies to influences of fatigue, pain, distraction, and uncomfortable weather conditions. If a person fights off their effect, the loss of efficiency is much less. Still, it should be emphasized that any prolonged attempt to defeat fatigue or to stimulate efficiency by artificial means, as by drugs, can end only in ultimate loss of efficiency. Possibly for a short period, such as an emergency when one must get a good deal done in a short time, one might fight off the effects of fatigue and stimulate efficiency artificially. The aftereffects, however, are not good; and in the long run, the net result will be less accomplishment than if one works an optimum amount from day to day.

**Caffeine, Strychnine, and "Pep Pills."**—These are stimulants, and, in general, they temporarily improve mental function and sensorimotor abilities. Caffeine is usually associated with tea and coffee, because those beverages contain it to the extent of about two to three grains per cup. Amounts of caffeine ranging from the amount in a cup of tea or coffee to three times as much have been used to test its effect on mental and physical abilities. The effect on typewriting, for instance, was found to vary according to the size of the dose(9). Small doses not exceeding three grains increase the speed, and accuracy is not impaired; but larger doses, between three and six grams, retard both speed and accuracy.

Small doses of caffeine also stimulate the mental processes. The effect is noticeable about an hour after the drug is taken and persists for several hours. Larger doses persist longer than smaller ones. No ill effects on efficiency result, apparently,



following the period of stimulation from small doses; but large doses cause it to drop below average when the stimulating effect has worn off.

Not much need be said about strychnine except that certain dosages might increase efficiency temporarily but the aftereffects are reduced efficiency.

"Pep pills" are sometimes taken by college students, particularly when they are cramming for their examinations. Some contain benzedrine sulphate to keep them awake so that they can study for longer hours than usual, and they are effective for that purpose. The use of such pills is not to be recommended, as their physiological effects are bad, namely, headaches, fatigue, sleeplessness, and poor circulation.

The use of drugs for psychological purposes results, in the end, in lowered efficiency. It is true that when a person is depressed and seemingly without energy, some drugs can be taken that cause a feeling of exhilaration and renewed energy. They also prevent sleepiness. Thus, if a person must drive an automobile all night or is active in an emergency, he can improve his powers temporarily; but, in general, efficiency can be maintained best by a sensible regimen of work, rest, recreation, and diet and by observing the established psychological principles of learning.

#### THE EFFECT OF HUMIDITY AND TEMPERATURE ON MENTAL ACHIEVEMENT

Teachers and school administrators lay great stress on the temperature of the schoolroom and the humidity of the air. Today, air conditioning has become an important industry, and the public is "air-conditioned minded." Educators are interested in temperature and humidity primarily because they are thinking of the health of the students and secondarily because they feel that unless the temperature and humidity are nearly ideal, learning ability is impaired.

Ideal temperature is generally considered to be about 70 to 72° and the proper relative humidity approximately 50 per cent. It is usually assumed that students work best under such conditions; but measurement of mental performance when the temperature and humidity are unduly high indicates that one can do just as well at such times as when those two factors are ideal. In a study of mental ability, the subjects were tested in a poorly aired room

where the temperature was 86°F. and the relative humidity was 80 per cent(10). The test consisted of doing problems in mental multiplication and in finding words opposite in meaning to given words. The subjects were tested for 4 hours each day on five consecutive days. They were also tested when the room was well aired, the temperature was 68°F., and the relative humidity 50 per cent. No essential difference was noted in the mental efficiency of the subjects in the two situations.

These results suggest that for a period of several hours, at any rate, human beings can adjust themselves to unfavorable climatic conditions and maintain their efficiency. Probably, if high temperatures and humidity were maintained for much longer periods, mental efficiency would finally be impaired, just as it was in the latter part of the long period of sleeplessness. Conceivably, then, efficiency may be maintained for a time when the atmospheric conditions are not favorable, but a depressing and enervating effect would set in after a prolonged period.

It is known from general observation that in geographical areas where the temperatures and humidity are high throughout much of the year, the intellectual productivity and creativeness of the people are low. The products of great energy and creativeness, such as achievements in art, letters, and science, are given the world principally by men and women in the temperate zones, where the climate is cold a portion of the time and never very hot and humid for a large part of the year. Statements such as these are not proof that high temperatures and high humidity affect mental efficiency, for possibly men with potential creativeness are attracted to the temperate zones by the greater opportunities there in industry, science, and art. These selective factors should always be considered. However, examples are on record of young men charged with ambition to do research and to write about it, who, after they have resided for a time in a warm, moist climate, have lost much of their interest and are no longer creative.

Experiments show that for a short period one can by determination overcome the enervating, debilitating effects of poor ventilation and unhealthful temperatures. But on the basis of broad experience and observation, apparently such conditions eventually influence efficiency. The work accomplished under experimental conditions is hardly what will be done in the typical

classroom. Teachers and administrators are wise, therefore, in regulating the temperature and humidity so that the room conditions are pleasant and comfortable. In general, if the room is kept free from drafts and the temperature and humidity are maintained at a comfortable level, the children will be happier even if not materially more efficient; and in the long run, they probably will be considerably more efficient also.

#### SUMMARY

In a true and theoretical sense, little or no decline in mental efficiency occurs throughout the school day, and adults, if not children, can maintain their mental power over a period of two or three hours, even at the end of the day, without any diminution in ability. There is, however, a loss of interest during the school day. To prevent this, the work should be varied and made interesting.

Feelings of fatigue may not be a true index of actual fatigue. Sometimes an additional stimulus revives interest, and efficiency is restored. If the fatigue is actual, however, efficiency will have to be revived by rest. It can be revived in some measure by varying the work.

Fatigue is induced by loss of sleep; overstimulation and understimulation; malnutrition; light that is too weak, too strong, or too glary; noise; diseased tonsils; decayed teeth; poor eyes; worries and fears. A well-planned program of good eating, work, recreation, and rest is the best preventative of fatigue.

The use of tobacco causes a slight decline in mental ability, steadiness, and motor coordination—possibly about 5 per cent.

Alcohol decreases efficiency in terms of the amount consumed. Small doses cause small decreases which wear off in a few hours; and, as is so well known, large doses cause almost a complete loss of efficiency for several hours. Caffeine up to three grains improves a person's reactions, but larger doses have a negative effect. "Pep pills" improve efficiency for a time because they prevent sleepiness. It is doubtful that any drug or stimulant is beneficial in the long run.

Human beings, for a short period at least, can be as mentally efficient in high temperatures and high humidity as when these two conditions are perfect. Possibly this fact proves what people can do rather than what they will do.

### Problems and Exercises

1. Because probably no real or true mental fatigue is induced over the course of the usual school day, explain whether or not the teacher is faced with the practical problem of keeping up the efficiency of his pupils.

2. If a child sits in his seat all day long, what type of fatigue is likely to affect his actual efficiency?

3. How can a consideration of mental fatigue only cause us to overlook the real, or practical, problem of fatigue?

4. What should govern the arrangement of courses or subjects in the school program? Illustrate.

5. Distinguish between mental efficiency in a test and experimental situation and that in the usual classroom situation.

6. What is the relationship of feelings of fatigue and actual fatigue as measured by tests of efficiency?

7. How does the nature of the tasks probably influence this relationship?

8. In an experimental situation, what is the effect of loss of sleep on efficiency?

9. What is the practical importance of loss of sleep?

10. Name as many factors as you can that cause fatigue.

11. Describe the type of teacher who might prove fatiguing to a number of school children.

12. Of the two drinks, beer or tea, which has the more stimulating effect on performance?

13. Does scientific evidence support the contention that tobacco gives the smoker a "lift"?

14. On the whole, what probably is the net effect of using drugs or stimulants?

15. Support your opinion on the practical and theoretical influences of temperature and humidity on mental efficiency.

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## CHAPTER XVI

### STUDYING EFFECTIVELY

**Directions for Study.**—A number of methods for studying effectively will be set forth, and the philosophy of some of them will also be given.

The importance of having a specific time and place for study is emphasized. In short, this is equivalent to having a definite habit of study.

Many students cram for examinations, and the value and disadvantages of cramming are described.

When beginning the study of a lesson, it is well to examine it first in a general way; then the lesson should be studied intensively.

Observe the importance of grasping the main idea of the paragraph and the mastery of difficult parts.

What is your reaction to the effectiveness of underlining, taking notes, preparing an outline, and the value of taking notes in response to the teacher's talking? \*

Some evidence is given on the importance of review.

Note that the alternative to preparing a lesson by rereading the same content a number of times is to study the subject in several sources.

How do students make a minimum use of difficult words, charts, tables, formulas, and questions?

How can a good assignment help the student? What are the values of pretesting?

Some evidence supports the whole method, and some the part, but the important problem is to apply the principles of these methods so that they will be effective in a number of different learning situations.

What conclusions do you draw from the facts on the relation of quality of scholarship to the amount of time devoted to study?

Give your reactions to the rules and methods of study that are listed in the tables.

Attempts have been made to increase the abilities of students through supervised study and the improving of reading abilities. Observe the results of those attempts.

Notice the effectiveness with which students study for examinations of different kinds.

Is it possible to do better work by having more to do?

What is the relationship of efficiency to short, medium, and long periods of work?

Methods of study vary with the purposes of the learner, which, in turn, reflect the methods of the teacher. If the teacher is a textbook teacher who "calls for" the facts of the book, the students will uncritically try to memorize the facts in order to repeat them to her. Then the method of study resolves itself largely into one of rote memorizing.

If the teacher's method is a broader one and tends to stimulate problem solving, critical evaluation, and the relating of knowledge, the student will prepare his lessons accordingly. Especially if the student, rather than taking the "next ten pages," is working on a problem or engaged in a project, he will search for information and relate and fit it into the problem that he is working to solve. A student should study with a clear purpose in mind so that he will be motivated.

\*

#### DESIRABLE ABILITIES AND HABITS

The first, and probably most important, thing is to acquire the habit of studying systematically. Effective methods of study consist basically of those fundamental principles which underlie efficiency. Doing one's work regularly, staying at it until it is done, and not getting behind in it are the general guides for successful study as well as for effectiveness in any field of endeavor. It is assumed that the student has ability enough to cope successfully with his academic tasks. Then the success of his responses to the tasks before him depends in a great measure on his efforts.

Certain general regulations should be followed to achieve efficient study habits. These apply to all but geniuses and very brilliant students, who have their own methods. It might be added that some students with very superior minds fail because they do not observe the best methods. Genius, however, should be exempted from the general advice that will be helpful to the

overwhelming majority of students. The genius, whatever his field, works in his own way, propelled by his great power and the stimulation from his environment to which most persons fail to respond. He should not be interfered with, as techniques of study are not meant for him and would only be an interference. The following methods and techniques if practiced, will improve most students' efficiency.

First, have a definite place and time for study. For the child in the elementary school, this is provided by the school program; and, because homework is being minimized for elementary-school pupils, the student does not have to organize his home environment for the purpose of devoting much of his out-of-school time for study.

It is more important for high-school students to organize their program so that they have a definite time and place for their work. High-school students have non-recitation and laboratory time during school hours, which they can either waste or utilize. Consequently, the budgeting of time must be stressed in high school.

As the college student is almost entirely on his own, if he does not organize his program of work so that his time for study is utilized, he is almost sure to fail. When he is not in class, his time is his own to use as he pleases. If he goes to definite places to study with regularity, he observes the basic principle for becoming a successful student. The best places are the study hall, the library, or his own room.

On the negative side, the student is advised to avoid loitering and loafing. It is so easy to spend an hour or two with other students between classes, sitting in a room merely talking or playing cards and other games. To move with despatch to the place where one can get right down to work requires self-discipline, which is difficult in the beginning but, when once begun, is not hard to maintain.

Definite periods and places for work are conducive to beginning a task. Half of achievement is accomplished if one gets down to work. If a start is made, the likelihood is great that the work at hand will be accomplished. Dilatoriness and procrastination are the most efficient enemies of achievement. The businessman, housewife, farmer, or student who never gets around to answering his letters, preparing the meals, beginning



the plowing, or attacking the lesson finds that his work piles up on him and that his accomplishments in the end are small.

In a student's home, it is often difficult for him to have a place of his own that is suitable for study. Altogether too frequently he must study in the kitchen, dining room, or living room where the presence and activities of the family distract him from effective study. The most isolated room in the house should be reserved for study when students are home. The difficulty of studying at home, because it is not a place associated so much with work but rather with eating, sleeping, play, or one's spare time, can be overcome if the place, table, and other equipment set aside for study are used exclusively for that purpose and not for visiting or playing games. For example, if students have a little library or place for studying, they might avoid using it for anything else by visiting or playing in another part of the house. In short, a definite place should be dedicated to work.

In a certain home, the piano was in a room known as the music room. The children practiced here but were discouraged from using it for other purposes. Whenever they were found playing dolls, cards, and other games in this room, they were tactfully directed to their own. Consequently, they thought of the room as a place for practicing the piano; and thus, when they went into it for that purpose, they were influenced to practice by the associations that they had with it.

**Specific Guides to Effective Study.**—Even though it is of basic importance that the student observe the general principles of beginning work without loss of time in places conducive to study or, in short, have a definite schedule of study, certain techniques will prove helpful in the actual process of study.

**Preparing for the Examination.**—Many students prepare for examinations by studying intensively just before the examinations are written. These students study only indifferently except when they *cram*—that is, try to acquire in a few hours or days of frantic effort what should have been learned by systematic effort over a long period of time, attempting to stuff themselves with enough facts and terms to pass. The crammer is hardly ever the student who tries to do exceptionally well in the courses themselves.

Cramming cannot be a sound method of studying, because it violates so many sound processes, such as thinking reflectively,

maintaining a critical attitude toward the references, relating new material to the old, and working in a thorough and painstaking manner. It substitutes haste for care, superficiality for thoroughness, and rote memory for reasoning and problem solving.

Furthermore, the student who crams has the attitude that the material is acquired only temporarily and for the purposes of the examination. Consequently, he is not learning it with permanent acquisition in mind; and when the examination paper is handed in, forgetting takes place rapidly. In the first place, there was no attempt at retention; and, secondly, the material was only superficially learned.

Occasions may arise when it is necessary to cram. If a person is in a situation where he must marshal many facts for a single occasion, he must cram them. The speaker preparing to discuss a certain topic or the lawyer collecting evidence on a case must cram considerable knowledge, transitory in nature, for the single occasion. However, the cramming is not effective unless the material learned for the moment is associated with a solid background of general principles and definite knowledge. The lawyer, for example, will learn temporarily many details about a specific case, such as persons, places, dates, and amounts of money involved; but in connection with them he will make use of his legal knowledge, which he knows, or tries to know, thoroughly. If he had to cram all the details and also the law involved, the likelihood is that he would not be a very effective lawyer.

The best preparation for examinations consists of thorough day-by-day preparation. The student who does not get behind in his work; always knows the assignment; and has the necessary books, papers, and other equipment will be the best prepared. Such a student can profit by systematic reviews and by more intensive study near the time of the examination, but he avoids the attempts to gorge himself with the whole course in a few hours, as the crammer does, just before the examination. In fact, the best preparation for one who has worked systematically throughout the course and made thorough reviews is to enjoy some recreation and go to bed early, rather than study late into the night. This method has not been proved experimentally, but some students have discovered that it results in satisfactory

achievement. Even though analogies are not always satisfactory, nevertheless it may be pointed out that athletes before a contest do not train rigorously up to the minute of the bell or whistle but do their intensive training well before the contest and then taper it off and engage in only light exercises. Light study and a short rest before the examination will probably enable the student to attack the questions with least confusion and greatest clarity of mind.

#### PREPARING THE INDIVIDUAL LESSON

A major part of most lessons consists of mastering a number of printed pages. On the other hand, in a subject such as arithmetic or algebra, the lesson consists largely of working a number of problems. Even though a few of the following suggestions for effective study apply more to such subjects as reading, geography, history, and literature, they apply to some, even though a lesser, degree to material like problems in arithmetic, algebra, and geometry.

**General Examination of the Content.**—If the lesson consists of a chapter, one should first so examine it as to acquaint oneself, in a general way, with the content. The reader can observe the headings and orientate himself to the content. This general orientation constitutes an intelligent preface to the intensive reading that follows.

In this connection, an opportunity presents itself to state that the lesson should not consist of the next chapter or the "next ten pages" but should consist of certain topics and materials that may be found in several references. The mere textbook method of teaching is very limited, and enrichment as obtained by means of extensive reference material is desirable. Even if there is a richness of materials, the problem of studying effectively is not solved and it is still desirable to practice the best methods of preparing the individual lesson.

**Intensive Reading.**—After a general survey of the material, it should be studied intensively. Some suggestions for effective intensive study follow.

First, do not hurry. Nobody can study in haste. Assume the feeling of digging deep into the lesson. If a student's state of mind is to get through his lessons quickly, his attitude is sure to render him ineffective as a student. There is complete incom-

patability between hurried studying and obtaining the thought of the printed page. The student hurries because he has other purposes more strongly in mind than that of studying, and the lessons are merely hurdles to overcome. If the teaching develops interests and an attitude for learning, such attitudes may be overcome. In fact, in every school there is a race and struggle between study activities and distracting tendencies to loaf, visit, and play. If the instructional forces are strong enough, the discipline of thorough study will be established.

**Master the Main Thought of the Paragraph.**—Every well-written paragraph should contain a main thought and its development. Not all paragraphs are well written; nevertheless, the student has the paragraph to master, and he should pick out its main topic. If he misses the main point, he should reread the paragraph.

**Study the Difficult Parts.**—One bad habit often acquired is that of sliding over the difficult parts. Portions of some lesson are sure to be difficult; and instead of reading them perfunctorily, they should be read and reread until mastered. If the difficulties are overcome, later material will not be burdensome; but when a student slides over difficulties rather than working through them, he piles them up against him. In short, he gets increasingly behind in his work because the failure to master the first difficulty makes harder the mastery of subsequent ones; worst of all, the habit of avoiding hard problems is developed.

**Underline, Take Notes, and Outline.**—As the student reads, he may find it helpful to underline the important terms, statement of principles, and topical sentences. Underlining gives the student practice in picking out what he thinks is important.

He should, of course, underline only in his own book and not in books belonging to anyone else or to the library. It is very distracting to other students to have to read a book that has been underlined. An additional reason for a student's having his own books lies in the values that accrue from a fuller use, which includes underlining, making notes in the margin, and even cutting out parts of the text material.

It is profitable to take notes on the material read; these should represent the important ideas. To a large extent, notes are cues to the content of the material that has been studied. They may also serve as a brief record of the difficult portions of

a lesson. They are especially helpful when the student wishes to refer to previous lessons.

Question may be raised about the value of note taking in class. In many classes, university and college classes in particular, the teacher talks—lectures, as it is complimentarily called—and the students try to take down what he says. This method has been described as the passing of the words from the mouth of the instructor to the notebook of the student without passing through the mind of either. It might be better teaching if the students were given an opportunity to react to what the instructor says by means of questions and discussion. Mimeographed outlines of the instructor's lectures could be given the students so that they would not have to be engaged in the process of trying to take down what the teacher says. Little virile interaction of minds occurs during the usual classroom lecture. Probably less note taking in the classroom and more in the library would represent a desirable trend in scholarship.

When material has been underlined, and notes taken, a profitable next step is the outline. A logical arrangement makes order out of unorganized material, and thus it can be learned more readily. The important should be distinguished from the unimportant, and the main points from the subpoints subsumed under them. Through the process of outlining, this may be done. Not only is outlining an effective method for the first learning of material, but it gives a basis for its review and recall.

**Recall, Summarizing, and Review.**—After the lesson has been studied, the student should reflect on what the author has said. By reflecting, he can attempt to recall the points in the lesson and evaluate them in order of their importance. In recalling, he summarizes silently and may find it profitable also to write a summary. Recalling the material and summarizing it not only tends to fix it in mind but also furnishes a basis for review.

Both the outline and the summary facilitate review. They should represent the basic framework of the lesson content; when a student reviews his outlines and summaries, he has the cues to the general content. It has been said that a review should be a new view. When reviewing, it is hardly adequate merely to reread the summaries and go over the outlines. Careful and studious attempts to recall related material will enrich the outline; and, in addition, correlated material may be recalled

also. The purpose of reviews is defeated if the student hurries over the outline. Instead, a new view is obtained if he reflects and recalls as many pertinent facts as he can and focuses them on the points of his outline. Summaries and outlines serve as cues to extensive materials that can be brought to mind.

The effectiveness of review was measured by testing the amount that could be recalled when the reviews followed learning by periods of varying length of time. Several groups were used so that the test for retention would not be repeated in examining the amount of retention after various weeks. The groups studied a historical passage of 25 lines on the origin of monasticism in Western Europe. It was scored as containing 43 separate ideas, or facts; the students were given 2.5 minutes to read it once and then, if time remained, to study it as they wished. They were tested on the passage by writing in essay form for 12 minutes; the results of this test provided the score for immediate recall. The reviews were like the original study and learning and were also followed by a test that was, however, not scored. After intervals of 2, 3, 6, and 18 weeks, groups of students were tested to note how much each group had retained. Some had had one review; others, two. The advantage of one review over no review may be summarized as being about 20 to 50 per cent, with the superiority less in the case of the longer intervals. The superiority of the two reviews over one review was larger, being about 75 per cent for the 6-week period and 57 per cent for the 18-week period.

Also studied was the effect of spacing the reviews 1, 2, 3, 7, and 9 days after original study as a preparation for a test given 21 days after original study. There was also a group with no review, and the results indicate that there is a definite advantage in a review but that it does not matter very much how the review is spaced. The amount recalled after 21 days from the time of original study varied little in terms of spacing of reviews within the 9-day period given, but review itself helped considerably in some instances and always helped a little.

**Relate New Material to the Old.**—An effective way of reviewing material is to relate or correlate the new with the old. Usually within the same subjects and among related subjects there is close connection as to content. When associations of this kind are made, the content is easier to recall. Whenever

meaning is enriched by additional knowledge, memorizing is facilitated.

For example, when studying in psychology the topics of heredity and environment and the nervous system, the student should review his work in the biological sciences. Similarly, if a grade-school student is studying the Civil War, he will find his field of study enriched by reviewing the geography pertaining to the climate and topography of the sections of the United States involved in that war.

The teacher, too, should relate the old to the new. One of the reasons why teachers need a thorough background of knowledge lies in the enrichment that can be achieved through associating old material with the new.

**Study in Several Sources.**—Even though a single reference should be reread until the material is mastered, still the pupil and teacher should not overlook the advantage of reading about the same topics in a number of sources. Authors treat the same subjects or topics in a different manner and provide different illustrations, facts, and interpretations. The freshness of different points of view adds a vividness and vitality to the lessons that are lost by several rereadings of the same lesson.

The problem of note taking may be complicated by the study of several sources rather than one. Notes taken may be taken selectively, however, and duplication can be avoided. By careful outlining, the main topics of the several references may be included.

**Words, Charts, Tables, Formulas, and Questions.**—Every student in his studying encounters the problem of mastering unfamiliar words; of interpreting charts, tables, and formulas; and of answering the questions usually found at the end of the chapter and occasionally at its beginning. Unfamiliar words should be looked up in the dictionary, and the meaning fitted into the sentence. A good plan is to keep a list of new words and review them occasionally. Better yet, of course, is to read so widely that the words are learned by frequent contact.

A common practice of readers is to pass over tables, charts, and formulas. They are included in order to summarize in effective form the data at hand and to provide data pertinent to the discussion. Often they require careful study and consequently are skipped. A good plan is to study tables, charts,

and formulas until every detail is clearly comprehended, and a conclusion drawn. In the case of the formulas particularly, it may be necessary to memorize them, but the meaning of the symbols should be understood before they are memorized, because memorizing meaningful material is more effective than learning material whose meaning is not comprehended.

Questions at the beginning of the chapters enable the student to prepare himself for the lesson before he begins reading and to test his knowledge after he has studied. Whether the questions are at the beginning or at the end, a good habit for a student to develop is to study them before beginning the chapter; to examine some of them again during the reading; and then, after the first reading is completed, to see whether or not he can answer them all. Reading the questions before studying and occasionally while studying causes the student to search for the answers. Thus, purpose and direction are given to reading.

In general, the principle of studying thoroughly and painstakingly applies to the meaning of words, to the interpretation of charts and tables, to the learning of formulas, and to the answering of questions. Careful work is of first importance, and beyond that there may be incidental techniques of importance also.

**A Good Assignment.**—In a sense, the questions that the author provides are his assignment, but the teacher also can give purpose and direction to the lessons by specifically directing the student to answer definite questions and to find information about specified topics. Some teachers discuss the new material to be studied with a view to interesting the pupils in it. Students must know definitely what they should do, or else they will work ineffectively. Discussion might center on whether assignments should be made frequently and thus cover comparatively little material at a time or should cover a considerable amount of material, such as several important topics. It may be contended that, if assignments are made every day, the students will not learn to work independently but will acquire the habit of being spoon-fed. There is considerable validity to this point of view, as one of the major objectives of teaching methods and how-to-study techniques is to train students to work independently through a large amount of reference material. Whether the



assignments are large or small, the teacher should develop a vividness about the work so that the students will have a motive and consequently will be interested.

**Pretesting.**—Students vary widely in the amount of information that they possess pertaining to the course before it is taken. In courses that are not highly specialized or technical, some students have sufficient knowledge at the beginning to pass with a fair mark. In fact, in some instances, the best 15 per cent of students at the beginning of the course obtain higher scores than the poorest 15 per cent at the end. A surprising amount of overlapping of scores is obtained on an examination given at the beginning and end of a course. Furthermore, even though considerable gain is made on the average, some answers that were given correctly at the beginning of a course are given incorrectly at the end. Probably some of these answers were not known in the beginning or at the end and were given differently by chance.

The problem educationally is to discover what the pupil knows and does not know before he takes a course and to direct his studying and learning accordingly. Going over material that is known causes a waste of time, and emphasis can be directed toward those phases of a subject about which the pupil knows least. Pretesting and diagnostic work gives a basis for more individual teaching and more fruitful study.

#### WHOLE OR PART METHOD

Much of the discussion concerning the superiority of the whole method or the part method centers on memorizing poetry. Shall the learner study and read the poem from beginning to end until the whole of it is memorized, or shall he memorize it line by line or verse by verse? The learning of poetry lends itself well to the discussion of the whole or part method, but the fact is that memorizing poetry in the average present-day school is a relatively unimportant matter. One might argue that there should be more of it, but at present most lessons do not include learning poetry by heart.

But the problem of learning by wholes or by part is applicable also to lessons in vocal and instrumental music, arithmetic, history, geography, reading, and other subjects. Natural, or normal, divisions exist in those areas, such as a song, an instru-

mental selection, a process in arithmetic, a chapter in history, a topic in geography, and a step in reading. One can practice the whole selection in music or parts of it at a time; in history and geography, part of a topic or the whole; in reading, a letter-and-word method, as in the case when phonics is used, or by larger units such as phrase and sentences, with little attention paid to the parts of the word. According to these examples, we have the principle of the whole-and-part method illustrated as smaller units against larger ones. The parts-and-wholes concept is really a relative one and should be considered as such.

A combination part-and-whole method should also be considered, as the method of learning need not be either part or whole but a combination of these two. Accordingly, there are many possibilities of combining the two. In practicing a piano selection, one may first play parts of it and then play the whole or play over the whole a number of times, practice the difficult parts, and then play the piece as a whole. Thus there are many possible combinations of the part-and-whole method.

There is considerable virtue in this method, as it can be used so that more time can be devoted to specific weaknesses. Thus if a health diagnosis shows that a person's specific weakness lies in excessive weight, attention will be devoted to exercises and modes to correct that deficiency. In fact, the whole diagnostic movement in education is based on the part-whole method with special emphasis on correcting weaknesses and then achieving competence in the entire process or problem.

**Comparative Effectiveness of the Part and the Whole Method.** Many experiments have been conducted to test the effectiveness of these methods and also of combinations of them. Some experiments favor one method, and some another, but probably more evidence exists in favor of the whole than of the part method. Nevertheless, little is to be gained by concluding that the whole method is superior and then proceeding to incorporate it into our educational procedures to the exclusion of others. Considerable discrimination is necessary; and instead of generalizing too broadly, we shall seek the qualities of each and examine the factors to take into account when evaluating the whole, part, or combination method.

The whole method has the advantage of causing the learner to work in larger units, seeing the interrelationship of parts and

obtaining their logical sequence. These ideas can be illustrated in the case of a poem of several stanzas. If the stanzas are learned individually, the general theme of the poem tends to escape the reader, and the relationship and sequence of the stanzas are not established. Instead of starting the next stanza when finishing one, the learner goes back to the beginning. This tends to establish the wrong order of connections—a fact that is apparent when children reciting their “pieces” have difficulty in beginning the next stanza and tend to go back to the beginning of one that they have recited. In general, logical and sequential order is established best by studying wholes or longer units.

The method of learning, whether by whole, part, or combination, depends on the difficulty of the material and the learner's intelligence. These two factors go hand in hand, because the difficulty of material should be interpreted in terms of the ability of the learner. Material that is difficult for a third-grade child is likely to be easy for a college student. Difficulty, in other words, is a relative matter; and ability, too, is relative.

If the material is difficult or the ability low, the value of the whole method is decreased, and that of the part method increased. Then the material should be assimilated piece by piece. When it is easy, or when the ability of the learner is high, the whole method is more effective, because the student can master larger units effectively, since he can comprehend them.

Furthermore, if the selection, chapter, or unit is difficult, the student who finds it hard to solve will become discouraged if he must attack the lesson as a whole. For a long time, no visible progress will occur, and discouragement may result; but if the problem is solved part by part, the learner will be encouraged by the feeling that he is making progress. In working arithmetic problems, for example, the solving of an individual one is what stimulates the student to work the next. If he had to do a single problem that took as much time as ten problems, he probably would turn away from his work before it was solved and accomplish less than when he worked individual problems spurred by the success of solving them.

Much stress has been placed on the value of the whole method, because it enables the learner to acquire the continuity of the thought and to see the problem as a whole. It follows, therefore, that the value of the whole method is in proportion to the mean-

ingfulness of the material learned. The more meaningful it is the greater the advantage of the whole method; and the less meaningful the less the advantage.

The instructor—and the student, too—should apply these facts and principles with discrimination, so that a maximum of learning can be achieved. In general, a student should conceive of his problem as broadly as possible and see its connotation and implications. When working on his individual lesson, he can enrich it by associating it with related ones. In trying to master material, it is effective to comprehend the whole in a general way, work on the difficult parts, and complete the lesson by studying it as a whole. No indisputable facts exist to prove one method better than another, but these general principles which have been set forth are a good general guide to follow.

### STUDY HABITS AND SCHOLARSHIP

If there is a causal relationship between study habits and scholarship, the students with better habits should obtain better marks than those who do not have such good study practices. Surely this would be true if other factors, such as intelligence or capacity, were equal. An investigation was made of the study practices of high-school pupils, those of grades IX, X, XI, and XII, to determine the relationship of study practices and scholarship(1). The students were given a list of study methods and procedures by which to check their practices as *never*, *occasionally*, *usually*, or *always*. They were divided into groups according to I.Q., and the scholarship determined for various practices of study whether *never*, *occasionally*, *usually*, or *always*. In general, the marks accompanied the extent of desirable practices. For example, the practices of looking up new words, skimming over material before careful study, reading silently without moving lips, getting lessons day by day to avoid cramming, and reviewing notes before examination were reflected in the students' marks. Those whose practice was *never* or *occasional* almost consistently obtained lower marks than those whose practices were *usually* or *always*. The differences were not large, but apparently those who received better marks had better study habits; and probably we may conclude that better study habits result in better marks.

**Scholarship and Amount of Study.**—A number of studies have been made, especially on the college level, to discover the relation-

ships among scholarship, mental ability, and number of hours per week devoted to study. The number of hours is usually determined by having students keep careful record of their study time. In Table XVII, the relationships are given among these various factors(2). In these data, the student who implies that he is bright because he does not study very much will find some support because of the fairly small but consistently negative correlation between mental-test rating and number of hours

TABLE XVII.—THE RELATIONSHIP AMONG COLLEGE SCHOLARSHIP, MENTAL TESTS, AND HOURS OF STUDY AS DETERMINED BY INVESTIGATION IN DIFFERENT UNIVERSITIES\*

|                    | 450 Syracuse<br>University<br>freshmen,<br>fall, 1923 | 221 Yale<br>University<br>freshmen,<br>spring, 1926 | 105 University<br>of Minnesota<br>freshmen,<br>fall, 1929 | 130 University<br>of Iowa<br>freshmen,<br>fall, 1928 |
|--------------------|-------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------|
| $r_{12}^{\dagger}$ | .60                                                   | .28                                                 | .65                                                       | .69                                                  |
| $r_{13}$           | .32                                                   | .00                                                 | -.06                                                      | -.28                                                 |
| $r_{23}$           | -.35                                                  | -.15                                                | -.20                                                      | -.41                                                 |
| $r_{12.3}$         | .80                                                   | .28                                                 | .65                                                       | .66                                                  |
| $r_{13.2}$         | .70                                                   | .04                                                 | .11                                                       | .00                                                  |
| $r_{23.1}$         | -.72                                                  | -.15                                                | -.22                                                      | -.32                                                 |
| $R_1(23)$          | .82                                                   | .28                                                 | .66                                                       | .69                                                  |

\* After Williamson, 1935.

† (1) Quarter or semester scholarship, (2) mental-test rating, (3) total number of hours of study for one week.

devoted to study each week. There is a moderate tendency for the brighter students to study less and for the duller to study more. The results from the various universities on the relationship of scholarship and hours of study, which range from a small positive correlation of .32 to about the same-sized negative correlation of -.28, show that no relationship exists in a group of college freshmen between scholarship and the number of study hours. This fact should not be interpreted as indicating that it does not pay to study a greater number of hours, because it should be remembered that abler students tend to study less than do duller ones.

In general, the best practice is for most students to study between 20 to 30 hours per week. Less than 20 is not enough to obtain optimum results, and more than 30, or possibly 35 hours,

brings diminishing returns. Long hours of study do not make up to any great extent for low mental ability. On the other hand, if a bright pupil spends too little time on his work, he will not become sufficiently acquainted with it and possibly will fail to do it satisfactorily. The failure of many to obtain satisfactory marks lies in their habit of not studying an average amount. In the case of all students who study average to maximum amounts and still fail, investigation should be made of those who fail, to determine whether their difficulties are special disabilities in reading, low mental capacity, health and emotional problems, or a wrong course of study. Experimental attempts may be made to improve the learning of the failing pupil on the basis of such analysis. In some cases, rewards will result in the form of improvement; but in many others, failure will continue. Control of study habits and the number of study hours may help, but no investigation has revealed any phenomenal results.

**The Most Important Rules of Study.**—Among the factors affecting efficiency in learning are the study habits of the learner. Evidence showing improvement from attempts to control and modify them is rather discouraging. Nevertheless, a teacher is inclined to train her pupils to adopt good study habits. A consideration of rules of study or advocated practices may make us conscious of habits that, if established early in life, may make a significant difference in the ultimate scholarship of a student.

An analysis of over 500 contributions on this subject resulted in the selection of the 10 most frequently mentioned rules(3). These are listed in Table XVIII as given in Cuff's article and, as he suggests, are probably the result of research at the college level and more applicable to college than to elementary- and high-school students. Still, many of the rules are applicable to students of nearly all ages.

These rules can be classified in a general way into two types: first, regularity and attention to study; second, the method. In the first category fall the rules of having a definite time for study, being alone, ignoring distractions, and studying in a favorable environment. Those pertaining to method of study are note taking, preliminary skimming of material, preparing illustrative examples, clearly defining the task, reviewing previous lessons, and silently reciting or reviewing lessons after having studied them.

Because many schools have supervised study periods, it is especially necessary that the teacher be conscious of the best methods of study. In many schools, part of the periods is devoted to supervised study, and then the teacher has her opportunities to direct the learning of her pupils by applying the rules of study. The danger of narrow and indiscriminate application of rules always lies in their use, but a teacher can find opportunity to generalize their application and develop good study habits in some of her pupils.

TABLE XVIII.—THE TEN RULES FOR STUDY MOST FREQUENTLY LISTED IN 500 CONTRIBUTIONS\*

| Rank | Rule                                                                    | Percentage of studies emphasizing rule |
|------|-------------------------------------------------------------------------|----------------------------------------|
| 1    | Have a definite time for study of specific lessons                      | 94                                     |
| 2    | Get lessons alone                                                       | 83                                     |
| 3    | Take notes on lectures                                                  | 72                                     |
| 4    | Ignore distractions                                                     | 66                                     |
| 5    | Skim over material before reading it in detail                          | 55                                     |
| 6    | Work out individual examples to illustrate general rules and principles | 52                                     |
| 7    | Seek a favorable environment for study                                  | 50                                     |
| 8    | Have a clear notion of the task before beginning                        | 48                                     |
| 9    | Review previous work before beginning an advanced assignment            | 47                                     |
| 10   | Recite silently immediately after reading a lesson                      | 42                                     |

\* After Cuff, 1937.

Besides listing the rules that have appeared most often, Cuff analyzed the study habits of elementary- and secondary-school pupils by asking them to check from a list of the 75 most frequently listed rules those which they practiced or observed. Responses were classified according to the quality of students as indicated by their achievement, test intelligence, and C.A. It was found, for example, that the duller students more frequently looked up new words in the dictionary and that the superior children did not to a great extent "recite silently immediately after reading a lesson." These are merely illustrative, suggesting that the study habits of the bright students are not always those recognized by authorities as being the best. Bright students are

able to learn because they are bright and, consequently, do not need to observe rules that are more useful and necessary for those who need help and guidance in their learning. It should be remembered in this connection, however, that very little evidence exists to indicate that the bright and able pupils are helped much by special methods and aids of various kinds.

Table XIX lists the rules or methods of study that differentiate most clearly the bright and able from the opposite groups.

TABLE XIX.—THE TEN MOST SIGNIFICANT METHODS OF STUDY CHARACTERISTIC OF HIGH-SCHOLARSHIP, MOST INTELLIGENT, AND UNDER-AGED GROUPS MORE OFTEN THAN OF OPPOSITE GROUPS IN 1,250 PUPILS OF GRADES FOUR TO TWELVE\*

| Composite rank | Question                                                                                                  | Answer by good more often than by poor students |
|----------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 1              | Have you a clear notion of the task before beginning the work of a particular study period?               | Yes                                             |
| 2              | Do you make complete sentences while writing?                                                             | Yes                                             |
| 3              | Do you seek to master all the material as progress is made from lesson to lesson?                         | Yes                                             |
| 4              | Do you grasp the meaning of a chart or table without difficulty?                                          | Yes                                             |
| 5              | Do you try to interpret work at a natural break in the printed material, such as at the end of a chapter? | Yes                                             |
| 6              | Do you take notes while reading or studying?                                                              | No                                              |
| 7              | Do you work out individual examples to illustrate rules and principles?                                   | Yes                                             |
| 8              | Do you provide yourself with materials required?                                                          | Yes                                             |
| 9              | Do you use facts learned in one class to aid in preparing for another?                                    | Yes                                             |
| 10             | Do you read each topic in a lesson separately until it is clearly understood?                             | Yes                                             |

\* After Cuff, 1929.

According to this, bright and able pupils have clearer notions of the work, grasp meanings, conceive of examples, and use facts more widely. That is not unexpected, because such abilities are symptomatic of brightness. Some of the rules, however, reflect good study procedures; and several of those given are excellent suggestions for the development of good study habits.



**Effects of Supervised Study on Weak Students.**—Because the colleges and universities have been faced, during the past decade especially, with the problem of caring for increasing numbers of weak students, various methods have been tried to save failing freshmen. Several investigators have concluded that attempts made to help students in the lowest intelligence-test quarter pay very small dividends. In spite of such conclusions, efforts continue for helping students of low capacity for college work.

One of the attempts consists of improving the scholarship of the lowest fifth of the students by supervising their study(4). An interesting experiment was made to discover the extent to which the scholarship of failing freshmen college students could be improved. Students in the lowest two-tenths on the American council test, except those with fair or better high-school records, were included in the experimental group. The control group consisted of those from two preceding freshmen classes who were in the lowest two-tenths also and also those from the class who could not be scheduled with the experimental group.

The experimental group met three afternoons a week from two to five o'clock for a whole semester. Two hours a week was used to discuss principles of study, and the rest of the time in actual study. Once a week, instructors would come in and help or advise the students on their courses but would not coach or drill them on their subject matter.

It was found that 54 per cent of the marks made by the experimental group during the semester of supervised study were C or over, whereas only 23 per cent of the control group did as well. On the basis of four years' work, however, little difference could be seen in the achievement of experimental and control groups. Most findings were to the effect that for the quarter or semester involved, improvement was brought about. But in the successive quarters and in the end, little improvement occurred. Therefore, apparently the supervised study or control over weak students must be maintained if worth-while results are to be obtained. Some investigators are pessimistic and feel that the first year's work of a weak student is such an obstinate indication of what he will accomplish in subsequent years that little can be done about it. Not very often do failing students, low in aptitude rating, change their status, even though they may make some

favorable response to supervised study or other controls over their method of learning.

**Improving Reading Ability.**—An effective method of improving a pupil's ability to learn is to improve his reading ability. Possibly the most nearly universal key to learning is the power to read. To a considerable extent, our knowledge is obtained by reading the printed page, and a large share of study and learning activity consists of reading text and reference books in the various school subjects. Even in arithmetic, algebra, and the other mathematical courses, teachers often maintain that the disabilities of many pupils lie in their inability to read effectively. Consequently, special training that improves reading ability increases the power to learn.

A special attempt was made to improve the reading ability of junior and senior high-school pupils who, reading tests showed, were a year or more below their grade level(5). Those selected for remedial work were organized into small classes, which consisted preferably of five or six. Classes of nine or more proved too large for the individual attention that effective remedial work requires.

Certain weaknesses characterize students who are a year or more below the average for their grade. They are weak in understanding the meanings of many words, in selecting the central idea of a paragraph, in comprehending the meaning of a sentence, and in their rate of reading. Certain other disabilities or weaknesses of the students became apparent during the remedial work. Their oral reading was jerky; they manifested difficulty in distinguishing meanings of words that differed comparatively little in their spelling; and they possessed meager vocabularies.

Treatment started by explaining to the students the general purpose of the class, so that they would have a cooperative attitude toward the work. The remedial work itself consisted of using lesson material from readers, science texts, and other books classified for grades one or two below theirs. The pupils were asked to answer detailed questions on the paragraphs, to prepare a sideheading for each of them, to match topic headings with paragraphs, to read paragraphs, and to recall the content. Workbooks in reading were used as well as means for increasing vocabulary, such as using new words in sentences, finding opposites, drilling on prefixes and suffixes, and working with cross-

word puzzles. The students were also trained to read more rapidly by increasing the eye span, and scores were kept in order to stimulate speed. Suitable books were recommended; the students were urged to read widely.

This remedial-reading program was carried out over a period of two years; then the students were tested to observe its effect on ability to read for details, the gain in vocabulary, the ability to obtain the central idea of the paragraph, the ability to understand sentences, and the gain in rate of reading. Nearly all pupils given remedial work showed improvement, the lowest average percentage being 88 in rate of reading, and the highest being 96 per cent in vocabulary.

The average improvement per grade ranged from 1 year 3 months for the twelfth grade in ability to read for details, to 5 years 3 months by the ninth grade in rate of reading. The progress made each 12 months by an average grade is 12 months, or a year, so that the additional progress because of the special training was equivalent to over 1 and up to over 5 years. Even though some of this gain is only temporary, retesting after a period of several months indicated that far from all the gain was lost. As the time after the period of special practice increases, the amount of the gain conserved decreases; in other words, time tends to wipe out much of the special gains. Consequently, a remedial program in reading, arithmetic, or any other subject should not be limited to a single period of several months but should be continued with reasonable consistency throughout as much of pupils' school careers as is necessary to maintain a high standard of efficiency in reading and in the other subjects. When the remedial program is over, students fall back rather rapidly in their abilities. Probably these losses can be prevented, and the gains conserved by a consistent, even though intermittent, plan of remedial work.

**Study and the Nature of the Examination.**—In order to investigate methods of study and efficiency of learning, students were examined after they had been told that they were to be tested by an essay, completion, multiple-choice, or true-false examination(6). The material to be learned consisted of a chapter on memory in a psychology textbook, and the students were helped by lectures, recitations, and supervised study. They were divided into four groups on the basis of the test to be given. All

students, however, were given the four types of test, two of which, the essay and completion, may be regarded as the recall type, and the multiple-choice and true-false as the recognition type. Results of the testing were analyzed to discover for which type they learned most efficiently and also to note the difference in methods of preparation for the various types.

In all tests—essay, completion, multiple choice, and true-false—the students who studied for the essay and completion test or the recall type tended to do best. Those who prepared for the true-false and multiple-choice tests did not do so well on their own tests, as did the students who had prepared for the essay and completion tests. The differences are not large, but neither can they be expected to be, as the material studied consisted of a single chapter, and the mind-set for specific kinds of test should not be expected to cause a large difference. The consistency of the difference in favor of study for the recall type of examination is important and indicates how the examination controls methods of study.

**Heavy Student Load and Learning.**—Some students, particularly in junior and senior high school and in college, are permitted to undertake a heavy load by carrying an extra subject. Students given such permission are, with rare exception, of high mental capacity or those who have demonstrated their scholarship by getting high marks. Often the teacher or principal is faced with the question of whether or not a capable and ambitious student should be permitted to take more than an average load. Will increasing the load from, for example, four subjects to five result in a poorer quality of work?

In general, it is safe to permit selected students to take an extra subject. When the required work is not enough to challenge their full efforts, they lose interest and neglect their work. On the average, their scholarship will not be poorer for the heavier instead of the lighter program. In fact, a slight improvement may result. It is a case of a busy person's doing many tasks with zest, whereas if he had few tasks to do, he would not do them so well. The acceptance of more work increases the feeling of responsibility, so that selected students will devote more intensive effort to meet the increased program.

Some pupils, if given more schoolwork, will not achieve so well as they did when their program was lighter. In analyzing

such cases, one should recognize that some pupils fluctuate in their scholarship even when their load remains average. Therefore, it is difficult to determine whether a heavier load or other reasons cause poorer work. Some pupils with no change in load show a marked decline also. On the whole, when selected students can take an extra subject or additional credits, they generally manifest improvement. If some individuals show a marked decline in scholarship, they should be carefully studied and observed to determine the reason. As a general principle, pupils should be given so much work that they attack it earnestly and with maximum interest.

**Distribution of Study and Practice.**—In the schoolroom, the program of study may be arranged so that the study periods are long, average, or short. In preparing lessons, the student may work on the same lesson for a whole evening, or he may divide his time of study among several lessons. A question may be raised regarding the length of period that is conducive to most effective learning. If a child, for example, spends 2 hours a week on her piano lessons, should she practice one long 2-hour period, two 1-hour periods, four 30-minute periods, six 20-minute periods, or eight 15-minute periods? Furthermore, it is important to know how much time should elapse between the periods of practice.

The period should not be too long because, during parts of it, interest will lag, and the achievement will be reduced. If, on the other hand, the periods are too short, time is usually lost in beginning and stopping, and the amount used in that way may be a large proportion of the total; the learner no more than gets well started, or "warmed up," before the time is over. Thus the pupil is cut off when the period of greatest efficiency is reached. If the period were longer, practice and learning would be continued through the minutes of greatest efficiency.

The length of the period should vary according to the age of the learner. In the matter of piano practice, which was used to illustrate the division of two hours into practice periods of different length, it is conceivable that for an adult expert in music who is motivated to achieve a high degree of artistry, long periods probably can be very profitable. They permit the practice of the material as a whole rather than restricting it to bit-by-bit work or practice on smaller pieces.

In the case of children, whose power to sustain attention is less than that of adults, short practice periods of about 10 or 15 minutes will prove more profitable than long periods. A short period of intensive practice is better than a long one in which the attention begins to lag and a distaste for practice sets in.

The length of the period varies with the nature of the material or subject matter. A drill period in addition combinations or the multiplication tables should be short. It has been discovered that drills of about 10 minutes in length can be just as effective as those two and three times as long. Daily short drills, in which sharp interest is maintained, is of maximum effectiveness for teaching the combinations in arithmetic, words in reading, and various facts in other subjects taught by the drill method.

In certain fields that by their nature are best studied through reflective thinking, careful analysis, and speculation, the periods obviously should be longer. Subjects like geography and history, if studied for their principles and implications, need longer periods for study and for the recitation.

When such subjects are taught narrowly and stress is placed on bare data and oversimplified events, the drill periods that may be described as "short and snappy" are probably best. A class period in geography or history devoted to a discussion of the reasons for events and the trend of situations and to making predictions or speculations should be more leisurely and extend over longer periods. One cannot, for instance, discuss the economic implications of the World War by the quick-drill method. The students will need time to set forth the facts and draw conclusions, which in turn should be criticised and evaluated.

If in a geography class the topic consists of whether the Dakotas should have been left as grazing lands or settled by farmers, who plowed up the prairie, the period should be longer than one devoted to drill about the location of cities in those states. Such a problem requires earnest and premeditated consideration compared to that required by the more mechanical phases of work. Critical and analytical work cannot be carried on in short periods.

Good scholarship is not nourished by the hurry and scurry that characterize so much of our schoolwork. Short hurried periods, speed tests, time-limit drills have their value in acquiring a number of skills; but if carried over to phases of schoolwork that

by nature require penetrating analysis and the making of associations, the result will be the acquisition of unrelated factual elements.

The optimum length of period depends to some extent on the age of the learner and the nature of the materials being learned. In general, it is a sound principle to have reasonably short practice, study, and recitation periods rather than long ones. The best length is one throughout the whole of which the learner maintains maximum attention and proficiency. If the period is too long, loss results because of reduced efficiency. Part of such a period could be utilized at a different task where interest could be maintained. If it is too short, the momentum of being underway is lost by stopping work when learning is at a high level.

The data in Table XX indicate that the learning period should not be too long; nor should it be too short, with a comparatively

TABLE XX.—THE EFFECT OF LENGTH OF PRACTICE PERIODS AND THEIR DISTRIBUTION ON ABILITY TO ADD TWO-PLACE NUMBERS\*

| Group | Practice period | Frequency    | Extent of practice | Gains in numbers attempted† |          |
|-------|-----------------|--------------|--------------------|-----------------------------|----------|
|       |                 |              |                    | Number                      | Per cent |
| I     | 60              | Once         | Continuously       | 4.1                         | 10.9     |
| II    | 20              | Once a day   | 3 days             | 14.7                        | 35.9     |
| III   | 10              | Once a day   | 6 days             | 15.3                        | 33.1     |
| IV    | 10              | Twice a week | 3 weeks            | 14.6                        | 28.6     |

\* Adapted from H. B. Reed, 1924.

† Gains were found by subtracting the number attempted the first 10 minutes from the number attempted the last 10 minutes.

long interval between periods(7). The findings indicate most conclusively that long single periods are least effective, probably because of a drop in interest and, if very long, because of actual fatigue. Periods can also be too short, and the intervals between them too long. The intervals should be of such a length that the learner is well rested by them and resumes the task with a maximum of interest and skill. If the intervals are too long, some of the acquired skill will be forgotten, and the learner will have to "warm up" to the task again because of a loss.

Thus, the period should be long enough to reach and maintain maximum efficiency; yet it should not be so long that efficiency

is lost. The interval between practice should be long enough to provide a complete rest but not so long that some of the previously acquired abilities are lost. If in doubt, tend toward shorter periods of learning, with practice almost every school day. Practice of three to five times a week is probably best, and once a week is probably not often enough. Many factors, such as nature of the material learned, the age of the learner, teaching methods, and the motivation, are to be considered in determining the length of practice periods and the interval between them.

### SUMMARY

A fundamental principle is actually one of industry—of working on the lessons; students should have a definite time and place for study and thereby establish the habit of study.

Cramming is ineffectual, because it results in superficial learning and quick forgetting. The best preparation is achieved by systematic and regular study distributed throughout the school year along with occasional reviews.

In preparing the individual lesson, it is a good policy to examine it in order to make a general, even though not thorough, inventory of it. The intensive reading that follows must be attempted without any hurry; the major point of each paragraph must be mastered; difficult parts given special study, notes taken of the leading points, and summaries prepared; and the reviews be more than just a repetition of the main points. It is better to read several sources on the same topic than one source several times. When difficult words, formulas, questions, tables, and charts in a lesson are passed over without mastery, much of the lesson is lost.

By testing their abilities before they begin a subject, a teacher can help her students study effectively; she can thus help them overcome individual difficulties. Furthermore, she can help by making assignments that direct their learning.

The usual conclusion has been that it is more effective to study by wholes than by parts; the evidence, however, indicates that either method or a combination of them may be most effective under certain conditions. The age, the ability of the learner, and the nature of the material studied determine the relative effectiveness of these methods.



Some evidence exists that students with good study habits learn more. The fact that students who get the highest marks do not study the most does not indicate that it does not pay to study; the ablest students tend to study less and still do the best work because they are the ablest. The optimum amount of time to be devoted to study is usually considered about 25 to 35 hours a week.

The rules of study emphasize habit and method, with habit involving time, place, and isolation; and method involving note taking, illustrations, clear objectives, reviews, and general thoroughness.

The purpose of supervised study is to develop good habits and methods. Attempts to improve the scholarship of college students through the development of effective study habits and methods have not been so very fruitful. It is possible that best results can be obtained by the training of elementary-school pupils.

Students study differently for different examinations, depending on whether they must recall the information or merely recognize it. The evidence favors the recall type of questions, and the examination should be of a kind that develops the best study habits and methods.

Some students may with advantage be given additional work, because they will do it better if enough is demanded of them to keep them busy.

There is no set rule fixing the proper length of study and practice periods. The length of period varies with the age and capacity of the learner and also according to the nature of the material being practiced or learned. A general rule is that the period should be of such a length that the learner works with the maximum of interest and concentration throughout all or nearly all of it.

#### Problems and Exercises

1. Describe the study habits of the best student you know.
2. What are some of the difficulties in having a definite time and place for study?
3. What are the psychological weaknesses of cramming?
4. A student thumbs the pages of his lesson to get a general overview of it. Is he justified?

5. Name the factors that contribute to intensive reading and study. Rate them in order of importance.

6. How can the principle of the whole-and-part method be utilized most effectively by a college student? By a teacher?

7. Explain why students who study least tend to have the best marks. Does the evidence indicate that only the best students study least? Is the proper conclusion that studying less will result in better scholarship?

8. Do you think that an average student should study at least 7 hours every day of the week?

9. Give your reactions to the rules and methods for study listed in the tables.

10. Why do you think that attempts to improve the scholarship of the students who receive low marks has proved so ineffective over a comparatively long period?

11. According to the evidence in this chapter, what type of examination do you think develops the best study habits?

12. Why will some students do better if given heavier loads?

13. Outline the principles that apply to the distribution of study and practice.

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## CHAPTER XVII

### LEARNING THROUGH TRANSFER AND MENTAL DISCIPLINE

**Directions for Study.**—Be able to explain the meaning of *transfer of knowledge* and also of *mental discipline*, with its assumption of the transfer of mental power.

Training value is sometimes attributed to certain subjects when it is discovered that those who have taken them are superior in their subsequent studies. The factor of selection is involved. Be able to explain and illustrate a common fallacy of confusing selection and training.

How are the principles of transfer and mental discipline related to the changes in our curriculum that have taken place during the last 40 years?

An engineering school operated according to the principles of discipline and transfer is discussed. Discover why its graduates were successful.

The theories of *generalization* and *identical elements* are given and explained. Be able to discuss them.

The amount of transfer varies according to the mental ability of the learner. Observe the relationship between the degree of mental ability and the amount of transfer.

In studying transfer from one language to another and from one school subject to another, note that the transfer is both positive and negative. Pay special attention to those facts and also to the amount of transfer.

Study carefully the summary of the investigations and experiments on transfer.

Pay special attention to the discussion on how to teach effectively in order to achieve mental discipline, the transfer of training, and the transfer of knowledge.

How have the curriculum and the content of courses been influenced by the experimentation that has been done on mental discipline and transfer?

**Introduction.**—A person learns through transfer to the extent that the abilities acquired in one situation help in another. Thus, there is transfer from Latin to English to the extent that a student is better in English than he would be if he had had no Latin. There is also transfer from grammar to composition to the degree that the study of grammar enables a child to express himself better than he would have been able to do had he not studied grammar.

Mental discipline refers to the training of the mental powers. According to this concept, a subject has disciplinary value if its study trains in observing accurately, thinking logically, developing powers of attention, and acquiring general mental power. According to such a theory, the study of geometry is believed to train the mind to attack problems logically; the study of Latin, to develop mental stamina, and the study of grammar, to increase reasoning power.

The disciplinary value of the study of logic was advocated for prelaw students by a president of an important university. He stated that, according to his observations, law students who had had courses in logic were superior law students, and he attributed this superiority to the disciplinary value of training in logic. He overlooked the fact that superior students elected to study logic and probably would have made equally good law students without the course.

It is also assumed, according to the theory of mental discipline, that the powers of discrimination, perseverance, analysis, and observation developed in one situation function in another—in other words, that powers developed are transferred from one situation to another. A professor of law had that point in mind, too, when he indicated that he preferred not students who had studied sociology, political science, and economics but those who had taken a considerable number of courses in mathematics. "They can think more clearly," he said, "and can solve the legal problems that confront a law student." This professor did not say that the knowledge acquired in mathematics helped in law but implied that the training, or mental discipline, obtained from the study of mathematics functioned in the study of law. Again, the selective factor was overlooked. Students who select mathematics courses and finish a number of them are likely to have the mental qualities that enable them to succeed not only in

law subjects but in medicine, chemistry, psychology, and other fields as well.

One learns by transfer when that which is acquired in one situation also appears in another. Thus, Latin helps one to understand English words to the extent that Latin elements occur in the English language. If Latin had no relation to English then no transfer would exist on this basis which has been described as *transfer according to identical elements*. Accordingly, most transfer occurs from one situation to another in which there are most identical elements, and least where the amount in common is least.

The gain from one situation to another on the basis of mental discipline corresponds to the extent to which the qualities and characteristics acquired in one situation manifest themselves in another. In some instances, there is little transfer. A scholar, for instance, who has a judicial temperament in his own field of study may not have the same qualities of mind when he is selecting his candidates during the heat of a political campaign. In such a situation, the mental discipline of one situation does not carry over to another. If a pupil works very systematically and rigorously on reading, history, and arithmetic but is inattentive and careless when cooking, sewing, and writing, then there is no transfer of mental qualities or training from the one type of situation to the other.

**The Curriculum.**—In the nineteenth and the early twentieth century, the doctrines of transfer and of mental discipline were commonly accepted by teachers and other educators. Even today, when this is being written, the distinguished president of Chicago University, Robert M. Hutchins, maintains that the major function of a university is to discipline the mind—train the students to think—and the systematic study of Latin and Greek is recommended for accomplishing that purpose.

When educators subscribed to the theories of transfer of training and mental discipline, comparatively few subjects were included in the curriculum. It was necessary to have only a few carefully selected subjects whose content had disciplinary value that would transfer to other situations. According to this point of view, many utilitarian subjects are not needed, because training in a few would give one the mental qualities that enable him to be effective in all situations.

The principle of learning through transfer of content learned in one situation to another and the functioning in all situations of mental qualities developed in a given situation so dominated the teachers of the nineteenth century that they accepted the utilitarian subjects of home economics and manual training, not for their utilitarian values but for the training and disciplinary values that they were assumed to have. Mechanical drawing, for example, was accepted in the curriculum by its teachers not for its vocational value but because the pupils would be trained in perception, would learn to visualize, and would develop a sense of proportion.

Now, however, the principle of transfer and discipline does not control the school curriculum. Subjects are included primarily because of their value in terms of social and practical standards. Skills and abilities are taught directly, as we no longer trust that we can learn indirectly by transfer. Educators and psychologists realize that the circumstances of life call for many specific functions which must be learned and that a general training is not sufficient. Consequently, we have many subjects in our curriculum. Another important factor that accounts for the large number of different subjects in our curriculum is our knowledge of individual differences in abilities and interests, and so we attempt to adjust subject matter and teaching to those abilities and interests.

**A School Based on Discipline and Transfer.**—We may describe in this connection an engineering school that operated on the principle that a thorough general training would enable its graduates to apply themselves successfully to specific technical problems. The students enrolled for the five-year course were required to take almost the same courses as did the students in the liberal arts or the science, letters, and arts college. They majored in mathematics, physics, and chemistry, but they also did considerable work in English, speech, economics, political science, and the languages.

These engineering students, of course, had some technical training also, such as mechanical drawing, surveying, and machine design. In terms of the practices of other engineering schools, the students of this one received relatively little training of a purely technical nature—only enough to give them a general orientation to engineering problems and practices.

The guiding principle of the faculty of this engineering college was one of training and discipline. They maintained that if their students were given a broad training in mathematics, physics, and other academic subjects that underlie engineering and, in addition, were trained in the bare minimum essentials of engineering, their graduates would be able to generalize their training and apply it to the larger engineering problems. They claimed that their students would become more than the technicians who do the elementary work in engineering, such as mechanical drawing, and that they would quickly develop to be consultants and executives. Their general point of view was that a broad general training in the fundamentals rather than detailed and specific training in the techniques gave them a quality of mind for functioning on a higher level.

An investigation of the graduates of this school seemed to substantiate the position taken by the faculty. They held good positions as executives and consultants. Their employment history indicated that they had spent only a year or two at apprentice work and that they soon acquired positions where they exercised initiative and control. These facts appear to support the point of view that good fundamental education can be generalized and applied specifically and effectively to problems at a higher level.

Another fact was discovered, however, that implied that the ability and success of graduates of the five-year course of this engineering school could not be incontestably attributed to the type and quality of education that they had received. The fact is that of those who enrolled as freshmen in this college of engineering, only 5 per cent finished the five-year course of study. Thus, the graduates were selected for high capacity and achievement. Only the best students survived to graduate. Consequently, they were the type who would be likely to succeed whether their training was general or highly technical and specialized.

It was pointed out that if the requirements for graduation included five years' study of the Chinese language, even better engineers would be graduated. Obviously, the extensive study of the Chinese language would not equip a student to become a better engineer, but the number of students who could and would get over that hurdle would be even smaller and thus still more



highly selected. In other words, the survivors of such a rigid requirement would be the hardest workers and the most intelligent. They would be likely, therefore, to become high-grade engineers.

**The Theory of Generalization.**—According to this theory, experiences, knowledge, and habits gained in one situation help us to the extent that they can be generalized and applied to another situation. In the engineering school just described, the faculty assumed that the students acquired methods of attacking problems and a body of knowledge and principles that they could apply to specific problems. Accordingly, a teacher who has learned the psychology of child behavior, the principles of learning, and the psychology of differences in capacity should be able to apply this knowledge to the classroom situation and teach successfully.

We may illustrate specifically with the following facts. A person learns in his science class that sound travels about 1,092 feet per second and that light travels about 186,000 miles per second. Can a person possessing these facts explain, when he sees a distant hunter shoot his gun, why he hears the report of the gun a short while after he sees the smoke? One who can apply his facts will be able to set forth the explanation that, because of the high speed of light, he sees the smoke almost immediately when it comes from the mouth of the barrel but the report is heard later because sound travels much more slowly than light and, therefore, reaches the ear an instant later.

In geography, certain principles are taught involving winds, water bodies, mountains, latitudes, etc., so that children will apply this knowledge in predicting the characteristics of a region and its industries. Certain facts and information are generalized into principles that can be used to solve and explain various problems. Thus, if children learn to generalize a body of geographical facts into principles, they can learn to use those principles in solving other problems in geography. A child soon learns the relationship between temperature and plant life and learns to make deductions on the basis of that knowledge.

In the field of psychology, for example, we may be taught that the basic urges and desires in man are the sexual urges and the desire for security. Much of human behavior can be generalized in terms of those two drives. A person's desire for prestige, per-

sonal worth, and a good position is based on the desire for security. Most of the appeals of the office seeker are made to this desire. The careful observer can explain how many purposes and reactions are governed by the wish for security.

We do not have exact information on how much is learned by generalizing knowledge or applying it to many situations. We do know that most of our inventions are arrived at that way. The scientist, for example, experiments, collects data, and makes a discovery or evolves laws and principles. If wide application is made of the discoveries or principles, then we say that they are generalized. The electromagnet, for instance, is a discovery that has been applied extensively. Its principles are found in hundreds of devices—telegraph instruments, electric motors, and the simple electric bell.

✓ The ability of individuals to generalize knowledge varies with the degrees of their intelligence. The most intelligent can generalize their knowledge in more situations and in the more complicated ones than can the less intelligent. Those of low intelligence can hardly do so at all. The power of generalization is greatest for those who can summarize their knowledge in words, figures, musical notes, and other symbols. The poet, artist, musician, and engineer have generalized in those terms.

The abstract element is very important; so, consequently, one's ability to generalize is a good index to the degree of his intelligence. Teachers should work for wide application of the facts, theories, and principles discussed in the classroom. The teacher who has a faculty of drawing her examples from many fields makes her pupils conscious of the interrelationships of facts and principles and their wide application. The history teacher, for example, when discussing the struggle over taxes during the prerevolutionary and revolutionary period, should aim at developing certain principles but might stop a moment and call the attention of the students to the tax problems confronting local, state, and federal governments today. Pupils and teachers might discover that the history of the tax issues of the eighteenth century will help them to understand the present tax problems. They might generalize even further by studying some of the problems in other countries also.

Furthermore, when a teacher in general science or physics teaches the interrelationships of pressure and temperature on

gases and requests that students memorize Charles's law, he might raise questions about the inflation of automobile tires in hot weather, ventilation, the combustion of gases in various types of engines, and the relationship of air pressure and weather.

The teacher of psychology might teach the conditioned salivary reflex by explaining clearly how a dog learned to salivate in response to the sound of a bell because the bell had been rung when the dog was given food. The following illustrates the principle of the conditioned reflex:

|             |                             |       |                                       |
|-------------|-----------------------------|-------|---------------------------------------|
| $S_1$       | (food)                      | $R_1$ | (salivation)                          |
| $S_2$       | (sound of bell)             | $R_2$ | (hearing or listening)                |
| $S_1 \ S_2$ | (food and bell<br>together) | $R_1$ | (salivation and listening<br>to bell) |
| $S_2$       | (sound of<br>bell)          | $R_1$ | (salivation)                          |

Food stimulates salivation, but the sound of a bell alone does not. When the sound as a stimulus is associated a number of times with the food stimulus, the sound of the bell alone will cause the salivary response.

A teacher should point out the application of this principle to the problem of changing or conditioning the behavior of people. He can show how we learn to be conditioned for or against certain things because they are associated. We learn to choose a certain soap because it is associated in the advertisements with certain people of prestige; we dislike people with a certain type of face because, at some time, a person with such a face offended us; and we avoid certain topics of discussion or certain fields of study because associated experiences have been unhappy ones. The pain and pleasure or satisfaction and dissatisfaction that have been associated with so many of our experiences determine to a considerable extent our behavior. The teacher should not only make application of the principle of the associated response by many examples and illustrations but should also encourage the students to generalize. Students ordinarily learn many facts and principles in rote fashion and may fail to transfer that knowledge to another situation unless the instructor trains them to see the relationship of that knowledge to other problems.

**Experiment on Transfer through Generalization.**—The theory of transfer through generalization was set forth by Judd, a dis-

tinguished psychologist and educator, about three decades ago. In collaboration with Scholkow, Judd set up an experiment for testing the ability of boys to hit a target that was placed under water. Some of the boys had studied the refraction of light—how it goes off at a different angle when it leaves or goes into a substance such as water, glass, or diamond. Others had not been given that instruction. We know that an oar in water does not seem straight and that a fish or other object is farther under the surface of the water than it seems. This is due to the fact that the light from an object under water refracts at a different angle when it leaves the surface and that when it strikes the eye the object appears closer to the surface than it actually is.

The purpose of the experiment was to determine if boys who had studied refraction of light could hit a target that was under water better than could boys who had not studied that topic. It was discovered that, when the target was 1 foot below the surface of the water, little difference occurred in the abilities of the two groups, but, when the target was raised to within 4 inches of the water's surface, the boys who had been taught the principles of refraction were able to adjust better than the others.

Hitting a target 4 inches under water is considerably easier than hitting one 12 inches under the surface. It is easier to estimate a "correction" for the smaller depth; and in this instance, the experience with the greater depth and a knowledge of light refraction enabled a quicker adjustment on the part of the boys who had a knowledge of refraction. This superiority probably reflects their ability to generalize their knowledge and experience by applying it to a new situation.

Interest always surrounds the question as to the extent that practice or training in one situation transfers and helps one in another. An experiment was worked out by Barlow with elementary-school pupils most of whom were seventh and eighth graders(1). The object was to discover how much the power to interpret Aesop's Fables was improved by special practice in reasoning and analysis. The subjects were tested both at the beginning and at the end of the experiment with a test consisting of 15 fables. One example was about a widow who fed her hen twice as much, expecting two eggs a day, the best answer or interpretation being that "figures are not always facts."

The experimental group had four lessons on analogies (boy is to girl as man is to ———), four lessons on analysis and the practices of generalizing from particular to general and from the general to particular, and four in analyzing behavior situations. In the lessons, the pupils worked over the material by discussing and explaining how they arrived at their conclusions. The control group did not have this practice, so the difference in the ability to interpret the fables as measured by the comparison of the tests before and after training by the experimental or practice group indicates the extent to which lessons in reasoning by analogies, by induction (concrete to general), and by deduction (general to concrete) improved the ability to interpret fables.

The net gain for elementary pupils was 64 per cent; and of the seventh and eighth graders, the upper half in intelligence gained 30 per cent more than the lower half. After a year's time, the subjects were tested again, and it was discovered that much of the gain had been lost. Still, this experiment shows that training in methods of reasoning with some materials transfers and improves ability in reasoning with other materials. Possibly in this experiment we have a suggestion that methods of teaching that cause students to study effectively are important from this point of view.

Transfer as a consequence of practice in outlining and summarizing was obtained with seventh- to twelfth-grade pupils in an actual schoolroom situation(2). This study by Miss Salisbury was similar to that by Barlow, because the practice was in method and the transfer was not a transfer in knowledge but a transfer in a skill or method obtained by the experimental group through practice. In this study, the experimental group was given 30 specially prepared lessons which consisted of material to be outlined and summarized. The practice consisted of picking out the author's main points, arranging them in logical order, and observing the "next steps" in thought; some practice also was included in preparing outlines for the students' own original compositions. The control group was not given this practice, and consequently the differences in the abilities of the two groups could be attributed to the practice.

The transfer effects were measured by testing the abilities of the control and experimental groups with a test of general mental ability; a reading examination; a reasoning test; and an achieve-

ment test in American history, civics, and general science before and after the practice period. If any transfer has occurred, the practice of extracting the thought from printed material by careful outlining and summarizing will show itself by improvement in the mental, reading, reasoning, and achievement tests. Thus, if one gains new abilities and improved methods for acquiring the expressed thoughts and ideas of some materials, it should show itself in the aforementioned tests.

A comparison of the abilities of the two groups, one with and one without the special practice, indicated the extent to which the effects of the special practice in outlining and summarizing came into play in the abilities measured by the mental, reading, reasoning, and achievement tests. To expect improvement in the abilities measured by a general mental-ability test is setting up a very high criterion for transfer, as it is most difficult to influence the scores on a test consisting of various exercises. It is not unexpected that practice in outlining and summarizing will be reflected in a reading test by which the ability to obtain the meaning from printed paragraphs is tested. To some degree, this ability may be expected to manifest itself also in reasoning and achievement tests.

The results indicate that an important carry-over occurred. The group with 30 specially prepared lessons showed improvement in all tests. The improvement in the mental-ability test was not large enough to be significant or attributable without doubt to the special practice. In the case of the reading test, the difference was large enough to be attributable without doubt to the practice. A difference expressed by a critical ratio of 3 is necessary before there can be no doubt that the difference is significant and not due to chance but to the actual effects being measured. The increase in reading was expressed with critical ratios of 4.7 for the seventh grade and 6.6 for the twelfth grade. Even though the ability to obtain meaning from printed paragraphs increased, the speed of reading decreased. Such a decrease illustrates a negative transfer. The practice of studiously outlining a selection resulted in slower and more careful reading.

For the reasoning and achievement tests, a carry-over in ability was also represented by differences large enough to be significant. The general results can be summarized by quoting from the study: "The mental skills involved in outlining and summarizing,

described herein as the processes of logical organization, transfer to produce improvement in general thinking or reasoning ability, as tested by problems not related to the specific school curriculum."

**Theory of Identical Elements.**—The two theories or principles commonly advanced to explain transfer of training are those of *identical elements* and the principle of *generalizations*. The principle of identical elements involves specificity and perception. The transfer depends on the extent to which specific elements exist common to each situation and the degree to which they are perceived. The principle of generalization, on the other hand, is conceptual in nature. Transfer depends on possessing a concept or idea and being able to apply it in another situation. In some respects, it may be difficult to distinguish the two theories, although the theory of identical elements pertains more to recognizing common elements in situations, whereas generalization is more the application of principles and concepts to situations based on seeing their relationships.

#### TRANSFER ACCORDING TO MENTAL ABILITY

In connection with the wide differences in the capacity of students, the question arises as to the relationship between transfer of training and mental capacity. Does amount of transfer correlate with capacity? In other words, is there a tendency for greater transfer in the case of the brighter pupils and less for the duller ones?

In general, the training values are greatest for those who are the brightest. The experiment by Barlow indicated this to be true. The abler learn more from a situation and can transfer more to another situation. Those who are poorer in one situation are relatively poorer in another. This was also shown in a study devised to test the effect of the study of science on the soundness or unsoundness of attitude toward life situations(3). In other words, an attempt was made to discover the extent to which a scientific attitude rather than superstitions and biases controlled one's thinking in a different situation. These factors were related to knowledge of scientific facts and principles. It was discovered that some with considerable knowledge could not apply it to situations, probably because they acquired facts and principles mechanically and by memorizing the content of the book. Many pupils who do well in the tests have acquired their knowledge in

that way. It was discovered, however, that those who apply their facts rationally are students of higher intelligence and have had greater experience in situations embracing the scientific facts involved. For example, the brighter boys experienced with electric irons, switches, coils, batteries, and similar equipment can apply the facts and principles of electricity more effectively. In other words, the transfer is greatest for them. Furthermore, persons with knowledge and experience can distinguish sound and valid explanations from fallacious ones. Two points have been made: (1) Most transfer occurs for the bright; (2) experience facilitates transfer.

Information about the comparative mental development of dull and bright, as a consequence of school training, was obtained from another experiment which consisted of relating growth in mental tests to the subjects that the pupils studied in the ninth, tenth, and eleventh grades(4). The tests, like the typical intelligence test, were given at the beginning. The purpose of this experiment was to determine the extent to which the abilities measured by intelligence tests were affected by the subjects studied in high school. The courses taken by the students were compared; and when they were similar for all but two subjects, then the training effect of those two subjects on general intelligence could be determined. Thus, if a group of children whose courses for the year were English, algebra, sociology, and Latin had the same initial ability and were similar in other important respects to another group who studied English, algebra, sociology, and economics, the differences in ability in the intelligence tests at the end of the school year could be attributed to the differences in the disciplinary and transfer effects of Latin and economics. The other three courses of the two groups were the same, so the only variables were the two subjects Latin and economics. For other groups of students, various other pairs of subjects were the differentiating ones. Groups were compared in this manner so that changes in ability could be attributed to the specific subjects.

In the present example, if the group studying economics scored higher in the end tests than the Latin group, then it may be implied that economics has greater disciplinary and transfer value than Latin, or vice versa. The other subjects studied by compared groups were evaluated in the same way, so differences



in mental ability could be attributed to the training effects of specific subjects.

The purpose of introducing this experiment at this time was to interpret the amount of disciplinary and transfer value according to the degree of brightness or dullness of the pupils themselves and not primarily to evaluate the effect of various high-school subjects on the development of general ability involving words, numbers, and symbol relationships. A quotation from Thorndike's study includes quantitative comparisons.

Let us now consider the results if we deliberately take the most favorable possibility for large differences between studies, by assuming that the gain from the experience of the examination itself is a special practice effect which is due wholly to that experience and is just as great for one program as for another and has nothing to do with the ability of the mind to think, or is correlated with it negatively, so that 11.9 points should be subtracted from all these estimates. We then have as the effect of the different programs:

22½ for the three courses in science and one in mathematics.

19 for one course each in Latin, French, algebra, and geometry.

17 for one course each in arithmetic, bookkeeping, stenography, and typewriting.

10½ for one course each in cooking, sewing, dramatic art, and physical education.

20½ for the best 1 per cent in initial ability.

1½ for the lowest 1 per cent in initial ability.

11 for the average white pupil.

1½ for the average colored pupil.

The gain from the more intellectual studies is larger relatively to that from cooking, sewing, etc., than it was before, but so also is the gain due to greater initial ability. . . .<sup>1</sup>

It might be emphasized at this time that no large difference existed in the influence of various subjects on the abilities measured. The differences were influenced by the materials of the test; some subjects, for example, influenced growth in word knowledge more than did others; and some influenced most the development of abilities involving numbers and space. Latin and French, as might be expected, reflected its influence most on

<sup>1</sup> THORNDIKE, E. L., Mental Discipline in High School Studies, *Journal of Educational Psychology*, 15: 94, 1924.

word knowledge; algebra and geometry caused relatively greater development in the tests of number and space. Conceivably, one could choose tests that would reflect greater training of a given subject, such as science courses, while others would favor mathematics; and some tests of a definitely verbal nature would show that English, Latin, and French have the greatest disciplinary and transfer value.

The conclusion to be drawn from the effects of specific school subjects on mental abilities is that no important differences occur. We can say definitely that subjects cannot be chosen for their disciplinary value or general improvement of the mind. There is a definite implication that a pupil should have as wide an experience with a number of different subjects as is possible and that we cannot depend on a limited curriculum to give him the richness of mental experiences that he should have.

Let us return to the topic of discipline and transfer according to ability. Comparison has been made of three groups: the highest 1 per cent, the average, and the lowest 1 per cent in ability. In the case of no group were the disciplinary and transfer effects large. It was very small in the case of the poorest 1 per cent of the high-school pupils. The average group developed about seven times as much as the poorest, and the brightest about twice as much as the average. Not too much significance should be attached to the numerical comparison of the development according to ability, as the quantities involved are small. If the development of one group is several times that of another whose growth is very small, the development of the superior group is still small and of not much importance, even though it is several times that of another.

An important fact is that in this experiment also it was discovered that bright children profit more from a situation than do the average pupils and that the average, in turn, profit more than do the dull pupils. Practically all experiments indicate that the transfer and disciplinary values of subjects tend to vary according to the mental ability of the pupils.

#### TRANSFER VALUE OF SPECIFIC SCHOOL SUBJECTS

Questions raised in connection with this topic pertain largely to the extent that experience in one subject helps in another, but interest also centers on the training and transfer value of

specific school subjects to vocational situations. The topic of transfer from subject to subject raises questions, for instance, about the help that Latin gives pupils when they study French, or vice versa; the extent to which a study of geometry helps a student appreciate art and design; how foreign language helps in the spelling and definition of English words; how extensively the addition process transfers to multiplication; the extent to which formal grammar improves written and spoken English; how much a knowledge of psychology improves teaching methods, and also how methods of teaching influence the practices and habits of pupils and the contribution that civics and sociology makes to citizenship.

**The Transfer from Languages.**—When the German explained: "I could English speak before I to America came," he gave an example of transfer from the German to the English. In this example, it resulted in awkward expression and may be described as interference, or a negative transfer. German may aid in understanding the English language if there are elements in common, but interference occurs when there are conflicting elements.

Investigations have been conducted that indicate how foreign languages help students in spelling and defining English words. Latin and French, for example, do help in this respect, but the transfer varies according to the nature of the words. If the English words are not derivatives of French or Latin, there is essentially no transfer; if they are, then transfer occurs.

It was discovered in a study of the effect of Latin on the ability to spell words of non-Latin and Latin origin that the study of Latin improved ability involving words of Latin origin(5). The usual technique of testing is that of measuring the spelling ability at the beginning and also at the end of the year to gage the gains made during the year. Then the effect of a year's study of Latin on spelling ability could be tested. Words of Latin and non-Latin derivation were used, and the pupils who studied Latin showed essentially no more ability to spell words of non-Latin origin than did those who had not studied it. The Latin students, however, did spell correctly more English words of Latin derivation than did the non-Latin students. The difference was not large but enough to indicate some transfer, which apparently took place according to the principle of identical elements.

When, however, an attempt was made to improve spelling of Latin derivatives by pointing out similarities, even greater improvement resulted in spelling English words of Latin origin. In general, there was no transfer to words without Latin elements; there was some to the Latin derivatives; and most took place when the teaching was directed toward bringing about transfer. This point is emphasized later in the chapter.

#### FOREIGN LANGUAGE AND KNOWLEDGE OF WORDS

The argument has been advanced that a knowledge of English words is increased by a knowledge of other languages. Latin, especially, has been supported on the basis that a knowledge of it transfers to English and, consequently, increases one's ability to use and define English words. French, too, has been defended as having similar transfer value.

In general, transfer value occurs from Latin and French to English. Not all investigations, however, are consistent in showing such a transfer. Most of them do, and it is safe to conclude that some transfer takes place. The amount of transfer depends to a considerable extent on the teaching method. If the teacher consciously works to improve the knowledge of English words by pointing out roots and derivations, then the amount of transfer is considerably greater than when no attempt is made to point out relationships and similarities.

**Latin and the Increase of English Vocabulary.**—The principle of transfer can be well illustrated by considering the effect on English vocabulary of studying and of not studying Latin. One study of this problem indicates that the growth of vocabulary is limited to words of Latin origin(6). At the end of the first-year Latin course, the gains of those who had taken the course were compared with those who had not studied Latin. Two lists of words were used. One contained 25 English words derived from Latin words included in the Latin course. The other contained 25 words also, but they were derivatives from Anglo-Saxon and Greek. On the basis of the test list containing Latin derivatives, the Latin students gained 5.5 words, and the non-Latin students gained 2.0. The gain of the Latin over the non-Latin students was 3.5 words. According to the list of words that were not of Latin origin, the students who had studied Latin for a year gained 1.2, and those without Latin gained 1.4 words, a net loss

of 0.2 word for the students of Latin, a loss that may be called inconsequential in terms of gain or loss. Nevertheless, it is important in showing that no transfer occurs for non-Latin words.

The transfer to Latin words is probably an important one, because a net gain of 3.5 words based on a test of only 25 words cannot be minimized. If Latin students are superior to non-Latin students to the extent of 3.5 words for every 25 words of Latin derivation, then they possess a superiority in vocabulary that is especially important for those who will enter the professions. This point of view should not be interpreted to imply that the most economical and effective way of learning English words of Latin origin is to learn them via the Latin route. Probably the understanding of words can be acquired best by studying them directly rather than indirectly through Latin. Possibly for those who need a broader background of scholarship, however, such as the teacher, lawyer, and doctor, some Latin might be worth while.

**Transfer according to the Method of Teaching.**—If the teacher makes a conscious effort to bring about transfer, then more transfer will take place. The Latin teacher, for example, can point out English words that are derived from the Latin. He can also point out the Latin roots in English words and build in the pupils a consciousness for seeing the common elements in Latin and English.

One teacher of Latin included in her method for relating Latin to English the analysis of some of the more formal statements that appeared in the newspapers. The Latin elements of the words were underlined, and the derivations explained and discussed. The number of English words that have Latin roots or are Latin derivatives in some of the speeches recorded in our newspapers is surprisingly large.

The facts are that greater increase in English vocabulary is produced when Latin is taught with special study of derivatives than is the case when Latin is taught in the usual way. Most, if not all, investigations indicate that more gain is made in the comprehension of English words when the teachers of Latin devote some time to the analysis of English words. The gain is greatest in words that are Latin derivatives and very small or nothing for words not derived from the Latin. This fact is consistent with the principle of transfer according to identical

elements or according to the extent to which the elements in the two situations are similar.

**Summary of Experiments.**—A summary of the investigations that have been made of the problem of transfer, as indicated in Table XXI, reveals that in 76 per cent, or approximately three-fourths, of the experiments considerable or appreciable transfer was found(7). Interference, which is negative transfer, was also discovered. It is not surprising that no transfer was found in a few studies, because in such a large number of experiments there are almost certain situations that prevail, and the content is of such a nature that no transfer is apparent.

There can be little question about whether or not there is transfer. The problem is an educational one for the teacher as well as the experimenter on how to achieve the greatest amount of favorable gain in one situation as a consequence of experience in another.

TABLE XXI.—STATISTICAL RESULTS OF TRANSFER EXPERIMENTS FROM 1890 TO 1935\*

| Findings                                           | Number of studies |       |       |          |
|----------------------------------------------------|-------------------|-------|-------|----------|
|                                                    | Laboratory        | Class | Total | Per cent |
| Considerable transfer .....                        | 24                | 23    | 47    | 28 0     |
| Appreciable transfer.....                          | 35                | 45    | 80    | 48 0     |
| Little transfer.....                               | 2                 | 13    | 15    | 9 0      |
| No transfer.....                                   | 1                 | 5     | 6     | 3 6      |
| Interference.....                                  | 4                 | 1     | 5     | 3 0      |
| Transfer and interference .....                    | 10                | 2     | 12    | 7 2      |
| Transfer varies with experimental conditions ..... | 3                 | 6     | 9     | 5 4      |
| Grand total.....                                   | 79                | 96    | 175   | 104 2    |
| Duplication.....                                   | 8                 | ..    | 8     | 4 2      |
| Net total.....                                     | 71                | 96    | 167   | 100 0    |

\* Adapted from table on p. 244 of Pedro T. Orata, *Transfer of Training and Educational Pseudo-science*, *Educational Administration and Supervision*, 21: 241-264, 1935.

## MENTAL DISCIPLINE, TRANSFER, THE SCHOOL CURRICULUM, AND TEACHING METHODS

Of one fact we can be reasonably sure, and that is that we cannot depend on a few subjects to give the richness of experience

and training that children need. A few subjects do not possess all the educational virtues. A study of a selected few will not train the mind and provide the information that is needed in many situations. Systematic and diligent translating of foreign languages, proceeding through the logical steps in solving mathematical problems, observing formal steps in grammar, etc., will not equip a person with the knowledge and abilities needed in many situations. If one is preparing to be a teacher, he should acquire a thorough and comprehensive knowledge of the subjects that he is going to teach and also of the allied ones. In addition, he should have actual training and practice in teaching. Whatever subjects in psychology and education he may take as preparation for teaching should be brought into relationship to teaching methods. Application should be pointed out, or else there may be little transfer to the teaching process.

The importance of actually applying methods and principles to teaching was forcibly brought to the attention of the author when he was delayed in meeting his class because there was so much confusion in making the assignment and distributing mimeographed material to the previous class. The instructor and students of that class occupied the room during the intermission between periods and also during part of the succeeding period. In response to the inquiry about the name of the class, the instructor replied that it was "Methods of Teaching." Apparently, no transfer was taking place from instruction to practice.

In general, then, the student should take the courses that are related directly to the problem at hand. The indirect method, which depends on transfer and discipline, is uneconomical and wasteful. If one is going to prepare for the profession of law, he should in the later stages of his preparation take those courses which are most closely related to law. It would be unwise, for instance, to study courses in mathematics, because its formal nature is purported to result in a formal discipline of the mind which prepares one to think logically and legally.

Neither should one study Latin and French for the sole purpose of understanding English. It helps, but it is more economical to study English directly. The claims for formal grammar have also been exaggerated. The study of formal grammar does not result in an improvement in written and spoken composition at all

commensurate with the time spent on it. More development results if the time spent on formal grammar is devoted to practice in improving written and spoken English directly.

Still, one should not take too narrow a viewpoint and be guided by the principle that only subjects should be studied that fall squarely in a field or are directly related to the object at hand. If, for example, a student in college or even in high school is studying to acquire a fair degree of English and French, it would not be amiss for him to take a little Latin and Greek and also a little Spanish and Italian. It may readily be admitted that the most profitable way to study English and French is not through studying the classical languages Latin and Greek or the romance languages Italian and Spanish but to devote the time to English and French. Yet for a person who desires a thorough knowledge of English and French, some knowledge of the more related languages will provide associations and give a background for a profounder understanding of English and French. Courses in other languages can be taken with profit, and the teachers should point out their relationships so students may interpret them more comprehensively. Furthermore, there is no hurry about students' finishing school, and most students have time enough to study allied material.

A student of history has a broader base for interpreting his materials if he is a fairly good geographer and is trained in relating geographical factors to historical events. The topics of discovery and exploration can best be understood in terms of climate, rivers, lakes, topography of the land, and natural resources. Similarly, our social and economic problems are related to these same factors and also have important historical implications. The Civil War for example, cannot be adequately understood without an understanding of the geography of the North and South with their resources and products and the conflicting social and economic forces.

In each of the fields, the languages, the social sciences (economics, sociology, history, political science), and the natural sciences (physics, chemistry, biology), there are interrelationships which should be pointed out. Facts in various fields should be brought into relationship. The thrilling relationships of knowledge make it educationally unwise to try to approach a problem in too compartmentalized a way. Related facts should



be brought together regardless of the field from which they are taken. Much better education will be produced by bringing to focus on a subject the pertinent facts from many fields.

✓ **Point Out the Relationship.**—In order to get the most out of any topic of study, its relationship to others should be pointed out by the teacher. In addition, she should encourage her pupils to look for relationships. Experimentation on transfer has made it clear that we cannot expect much unless teacher and pupil are conscious of the interrelationship of knowledge and attempt to generalize knowledge or apply it widely.

The question is less one of the existence of formal discipline and transfer and more one of instructional methods. The teaching needs to be planned to bring about transfer. A related problem is to bring knowledge and information together that logically belong together and not to compartmentalize them as we now do. If the teacher of Latin and Greek, for instance, discusses prefixes, she should point out their extensive use and even help the students to find examples of their uses. For example, the prefix *hypo-* is used with words occupying several columns in the unabridged dictionaries, and words with the prefix *hyper-* occupy several columns also. These and other prefixes are important. A knowledge of the extensiveness with which different prefixes are used will help make language teachers more sensitive to the opportunity of sharpening a pupil's awareness to prefixes and of enlarging his background for understanding the meaning of the words with prefixes and suffixes.

History is often compartmentalized as a separate subject consisting of dates, battles, wars, and the recitation of various events. History should be a story of the past which describes and explains the forces and factors that cause people to behave as they do. True history of that type will help us understand people, interpret their behavior, and predict what they will do under certain circumstances. History treated richly is broader than the usual mechanical type of history teaching and brings to focus historical problems; the psychology of human nature; numerous geographical facts and principles; the economic forces involved; the beliefs, traditions, motives, and attitude of the people; and the other forces that underlie the behavior of people. We cannot expect "date, name, and battle" history to transfer over to everyday living and to help students interpret the social and economic

problems of the present day. History will do that when it is conceived more broadly by scholars and teachers and when it is made a living subject rather than a dead one.

As a student, the author took a college course in history called "The Modern World," which included the seventeenth, eighteenth, nineteenth, and twentieth centuries. He had just lived through the World War and was intensely interested in the world-stirring events that had taken place, so he hoped to obtain an interpretive basis for understanding them. Instead of being living and vital, the course consisted, by both "lecturer" and students, of a superficial recitation of events anchored to their dates. Before the great events of the twentieth century were reached, the course ended, and it was just as well.

It may be maintained that because of the form the work took—memorizing details, dates, and events—the course had good disciplinary values. However, no one in the light of modern psychological findings on that topic could seriously defend this. According to the findings, little transfer to present-day events would exist. Instead of keeping history buried in the vault of the past by making it merely a monotonous and mechanical procession of past events, it could be made the roots of the present. We could learn to trace present situations back into the past and thereby interpret the present more profoundly. Whether history as a subject is merely rattling the dead bones of the past or the living story of man's attempt to adjust to his environment depends in large part on the teacher. He has to plan his assignments, organize the material, and ask questions or stimulate his pupils so they achieve a wide orientation to the field of study.

**Subject Matter and Function.**—Experimentation has shown that the values ascribed to the study of formal subject matter according to certain theories of discipline and transfer of training are not so great as has been claimed; consequently, educators have turned their attention to the selection of subject matter that is actually used by the people. For example, in arithmetic, studies have been made to determine the arithmetical processes that are actually used. The arithmetic used by bank clerks, store clerks, and housewives has been determined by finding out the arithmetic that they need and use in their everyday practices. Examination of newspapers and periodicals has also

revealed the quantitative materials that are met with in one's general reading. So in present-day arithmetic problems, we do not find those that fall far outside actual experience. In modern arithmetic lessons, the hound is not sent after the rabbit who has a 300-foot start, and the pupils are not asked to find out how many bounds the hound has to make to overcome the rabbit if the rabbit leaps 3 feet at a time and the hound jumps 4 feet each leap. Neither do we mix 3 gallons of \$2.00 wine,  $5\frac{1}{2}$  gallons of \$2.50 wine, and  $7\frac{3}{8}$  gallons of \$2.75 wine to find what the resultant mixture costs per gallon. Problems in wallpapering, plastering, apothecaries' weights, surveyors measures, etc., are found only to a limited extent, if at all, in the modern arithmetic texts. Problems of that type were thought to have value in training the mind to reason logically; but because it has been learned that training values are not inherent in any specific type of problem, we choose problems that are realistic, or true to life.

Spelling texts no longer contain about 25,000 words many of which never fall within the written work and the reading of either children or adults. Obscure words are now omitted from the spelling lists. Words that are actually used by children and adults are selected. Letters written by children and adults have been examined to discover the words actually used and misspelled. Children's compositions and other written work have been examined also. Words most frequently used and frequently misspelled are listed according to such frequency and then graded. It is much more to the point to learn to spell the words that we use than to spell obscure words that occur seldom, if at all, in either our writing or reading. To a large extent, this principle applies to other fields of study.

Investigations of the effect of the study of formal grammar on spoken and written English indicate that it has little value. The values from the practice of parsing sentences and elaborately diagramming them to indicate the various parts of speech transfer very little if at all to speech and composition. A few decades ago it was contended, and with little contradiction, that such formal practices produced disciplinary values for developing the power to reason logically, sharpening the faculty of making fine distinctions, increasing the power of attention, and developing accuracy. Not only are these powers not developed, but negative results occur. The practice of laboriously analyzing sen-

tences grammatically develops habits that cause one to read less fluently.

Grammar can be used to improve written and spoken English, but grammar will not influence one's English if it is just left to happen. The most effective approach to the problem of improving speech and writing is to bear in mind the common grammatical errors. Studies have been made to determine the most common errors by observing and recording those which children make in their speech and in their writing. Most common errors involve subject and verb and the cases of the personal pronouns. For example, a common type of error is the following: *One of the girls are going to the country.* The verb and the subject do not agree. In such an instance, when the error is at hand and the correction is being pointed out and explained, the teacher can set forth some of the grammatical principles covering the specific errors.

A common error is also illustrated by the phrase *between you and I*. In explaining that the phrase should be *between you and me*, it helps to give the reason by pointing out that the preposition is followed by the objective case of the pronoun. When grammatical facts are applied to specific errors, they serve as reasons and explanations and provide direct aid for correcting and preventing errors.

A difficulty in employing grammar in this way lies in the fact that grammar cannot be used to explain to young children the nature of their errors. Children acquire their language from their environment. If they hear only good language, they will speak correctly; but if they hear defective language, their speech will reflect such experience. Young children will have to be taught the correct form without being given the reason for it. When lower grade pupils become "grammar-grade" pupils, they will still persist in most of their errors, and then they can be given grammatical explanations.

**Formal Discipline and the Training of Pupils.**—Even though it may readily be granted that subjects whose values are not very apparent should not be studied because of purported disciplinary values, teachers must not overlook opportunities to train their pupils in the habits of good scholarship. The teacher's methods and procedures may, on the one hand, help to develop carelessness, indifference, and inability to concentrate or, on the other,

train them to express themselves clearly and fully, prepare their lessons carefully, and maintain attention to the problem under consideration. Considerable dispute may arise as to how pupils may be trained in the habits of good scholarship, but hardly anyone will deny the value of good classroom methods even though we no longer attribute disciplinary values to specific subjects. Under a good teacher, children will acquire the habit of being industrious and will develop a willingness to undertake difficult problems. Children may, if under poor control or if poorly motivated, become careless and indifferent. Their attention deteriorates into the type that flits about from one object to another. Discipline and training interpreted broadly in terms of the qualities and habits that characterize good and poor scholarship should be recognized as very important. The teacher should interpret her work occasionally in terms of its effect on the interest of her children; on their capacity to work independently; and, in general, on the habits of scholarship that they are developing.

The training that children receive in different school situations differs according to the control and motivation that exist in those situations. If assignments are indefinite, if the children are uncertain, if there is much disorder, and if confusion characterizes most of the activities, the pupils will develop poor work habits and become less effective in dealing with school situations.

Training and discipline are important in this sense. Even if we train children so that they have the technique for solving their school problems, we are not sure that they will have the ability to attack other problems or that the habits and characteristics acquired in school will carry over into adult life. Possibly there may be some carry-over, as habits acquired in childhood are stubborn and tend to persist a long time. Even if there were no transfer, the value of good training during and for the school situation is important in itself. A common aberration in our thinking is to conceive of training and discipline as intended for a situation or time different from the present. It is significant that the teacher develops interests and good habits for the situation at hand. It probably is not most desirable that the teacher have foremost in mind the training or discipline of her pupils for adult life situations. The immediate situation is primary. That good training persist and that it carry over to all situations is, of

course, to be desired. The "carry-on," or "carry-over," quality of training should be looked for, as a pupil may be well controlled in one situation but in others show no effect of control. Still, the education of the child for his present should govern the teacher more than concern for his future.

Children in the schoolroom, because of strict control, may prepare their lessons diligently and recite according to fixed pattern. The teacher makes assignments; the pupils prepare and recite them to her. They go through the "form" of lesson getting. Generally, the desired habits, or "disciplines," of scholarship are not established, because the pupils studied under compulsion and because they were working for such artificial rewards and external satisfaction as teachers' approval. Most students cease to study as soon as they finish school. There is little carry-over, because they had no true motive for learning. They were compelled by teacher-pupil relationship to study, but little if any propelling interest was generated. Most of our formal educational work of the compulsion, lock-step type shows little carry-over, and the graduates of our schools carry on practically no independent study. When the compulsion of the teacher is removed, the pupils do not manifest any habits of scholarship. Formal processes directed from the outside, which involve much repetition, do not result in the establishment of controlling aims and dominant habits. Mere mechanical form or going through the motions under direction does not develop habits that govern behavior. Only activities that are permeated with interest, motive, purpose, and their associated feelings will result in a training and mental discipline that has significant value.

#### SUMMARY

Mental discipline refers to the development of mental powers through systematic and vigorous study. Transfer of training refers to the transfer of these powers to situations other than those in which they were acquired, and the transfer of knowledge refers to the transfer of knowledge acquired in one situation to another. Special disciplinary and transfer values have been attributed to certain courses; in most instances, however, it is not the inherent training qualities of the course but rather the fact that certain courses are selected for study by the more gifted students.

When the doctrines of mental discipline and transfer dominated American education, the curriculum contained relatively few courses. They were largely arithmetic, grammar, algebra, geometry, physics, and Latin. Today, many courses are included because educators believe that in order to acquire skill and ability, the learners must acquire them directly.

The discussion of the engineering school was included in order to illustrate the principles of high selection as the controlling factor in success rather than the training based on the principles of discipline and transfer.

The theory of generalization is conceptual in nature and is to the effect that the learner applies certain knowledge, principles, or concepts acquired in one situation to a new and different situation.

According to the theory of identical elements, the amount of transfer from one situation to another corresponds to the extent to which the two situations are identical. The amount of transfer will depend upon the learner's perceiving the identical elements.

Experiments on the transfer of training and of knowledge indicate that transfer exists. In fact, most experiments have demonstrated the presence of transfer, but differences in the amount are very apparent, with about three-fourths of the experiments indicating appreciable or considerable transfer.

Transfer varies also according to mental ability, being greatest in the case of the brightest children and least with the dullest. This is the general trend only and does not hold without exception for every individual.

Students of psychology and education should not dismiss this problem of transfer by merely learning the facts about the amount of it but should consider the problem of how to generalize knowledge and apply it to different situations. Consideration should also be given as to how knowledge is interrelated, how applications can be made, and how awareness is developed to the similarities of knowledge in various areas. Teaching should emphasize application and interrelationships and should aim to bring about transfer of training and knowledge from one situation to another.

### **Problems and Exercises**

1. Give an illustration of mental discipline, transfer of training, and transfer of knowledge.

2. If you were the president of a teachers' college or the dean of a college of education, what type of students should you try to select; and, in general, what training should you give them?

3. If you list the subjects taught today in the elementary grades, high school, and college and list also the subjects taught in these divisions 40 years ago, you will notice a great difference in the number. Give the psychological reasons, but do not lose sight of the sociological and economic reasons.

4. What virtues do you think may exist in the principle of discipline and transfer as applied to teachers' colleges, colleges of education, engineering schools, or any other professional schools? What are the limitations of applying this theory to a school or college?

5. Give illustrations of the application of the theory of generalization, and also give examples illustrating the theory of identical element.

6. What are some of the principle elements in the experiments on discipline and transfer that are given in this text?

7. What is your reaction to the concept that more transfer occurs in the case of bright children than dull?

8. After reviewing the evidence on transfer and mental discipline, do you believe that students with high academic abilities should take a large number of related courses even though the transfer is not exceptionally large?

9. Specifically, do you think that the student of English should study Latin and French; the student of physics, mathematics and chemistry; and the student of history, geography, economics, and political science?

10. What conclusions do you draw from the evidence given in Table XXI?

11. In order to get the most out of any subject, what should the teacher and pupils do in order to avoid compartmentalization of subject matter?

12. Give illustrations of how a subject was broadened and enriched and also of how a teacher kept a course in a narrow and restricted area.

13. What is your reaction to the large increase in the number of courses and the tendency to make the content more real and lifelike?

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## CHAPTER XVIII

### THE ACTIVITY AND PROJECT METHOD OF TEACHING—INFORMAL AND INCIDENTAL LEARNING

**Directions for Study.**—This chapter will take up the subject of learning in classroom situations where the methods of teaching are both traditional and modern. Because of the great range in teaching methods, the reader should be aware of the better known, newer methods and their effectiveness. At least, he should know that the traditional methods are being challenged.

One of the more progressive methods of teaching is through projects and activities. Acquaint yourself with it.

What are the terms stressed in the traditional method of teaching and also in the newer type?

Note why the ardent devotees of any system of teaching are likely to obtain better results.

Several experiments are reported; acquaint yourself with the procedures and results.

As you read the pages of this chapter, determine whether or not you believe that the subject matter will be covered and learned by the more informal method of teaching.

Observe the theory of Mr. Benezet in postponing formal arithmetic until the upper grades.

**Introduction.**—Methods of teaching range from the rigorous question-and-answer, textbook, and drill method to the project and purposing type of teaching. The former makes little appeal to motive and does not stimulate an activity program; the latter is based on problems, purposes, and motives.

Heated controversy has waged for many years over the effectiveness of the older and newer types of teaching. The experimental evidence is not one-sided, with all of it supporting one type of method. Some evidence indicates that pupils taught through drill and reviews, with emphasis on the acquisition of facts, do

better in examinations designed to measure the extent to which facts have been acquired. Progressive educators insist that education consists of much more than the acquisition of facts and even insist that besides acquiring many other values the children actually learn more facts under the project, activity, and purposive method than under the more traditional type of teaching.

Teachers and administrators today are deeply interested in the activity, or project, method of teaching. This movement is at present attracting the interest of educators as hardly ever before. Leaders are arguing heatedly, and even bitterly, over its merits and demerits. We have the "progressives," on the one hand, advocating this method of teaching and sponsoring experiments; on the other, we have the "conservatives," denouncing some features of it and pointing out the virtues of the more formal methods.

The activity method of teaching is not new. It is probably as old as teaching itself. Some teachers have always taught by means of controlled activities and larger units, and there have also been philosophers throughout the ages who have expressed disapproval of the rigorous, formal, lock-step type of teaching and advocated a more liberalized method based on the pupils' normal interests and activities.

Some fundamental differences exist in the more common traditional type of teaching and the newer methods that have been designated as the *activity method*. The traditional method is more formal and systematic. The work is divided into definite courses, or subjects. Lessons are assigned, and formal recitations and examinations are considered very important. The program is carefully planned and diligently followed, with a specific time and place for each subject. Drill, review, and systematic study are stressed, and such terms as *thoroughness*, *mastery*, *habit*, *skill*, and *knowledge* are used to describe the objectives and outcomes. The teacher is conspicuously in control, and the work usually centers on the content of textbooks.

The activity school is less formal and lays stress on activities and projects that are lifelike and appeal to the pupils' natural interests. The teacher is in control but less conspicuously so, being less master than in the traditional schools but more a guide and helper. During the course of the school day, the students have units of work, are engaged in projects, take excursions,

sions; and the aim is to acquire abilities, knowledge, and skills through these projects and activities instead of reading assigned pages in a text or working the next 10 problems in an arithmetic assignment. Students under the activity method will have a school garden; do school banking; audit school accounts; and, through series of units and activities, gain the skills and abilities that are acquired more directly in the formal study stressed in the more traditional school.

In the philosophy of the activity school, terminology is quite different from that of the traditional school. Instead of stressing *drill, thoroughness, and discipline*, the terms employed are *interest, purpose, attitude, learning in a natural situation, and learning psychologically* rather than *logically*. Exponents of the activity method state that education is much more than acquisition of facts and skills and is more concerned with the developments of interests, initiative, and the desire to learn.

Those who attack the activity school usually claim that the children do not acquire the fundamental abilities that almost everyone agrees are essential. They insist that the activity, or project, methods are largely hit-or-miss and leave too much of the control to students too immature for such responsibility. Students' own interests are not a safe guide to follow, according to those who favor the more formal type of teaching. As a net consequence, the work is indefinite, often chaotic, and the students do not learn the subject matter.

The sponsors of the activity movement state, however, that their students learn as much, and probably more, subject matter and that they gain many intangible values not acquired in the usual schoolroom. They point out that in spite of drills, reviews, questions, and answers of the traditional school, many students fail to learn effectively. They also mention that students of the activity school actually acquire more information and have more knowledge than do students in schools laying the greatest stress on such acquisition and also that the interests, needs, and wishes of the children are observed to a greater extent than in the more conventional type of school. Furthermore, those of the activity school maintain that much of the learning in the typical school is artificial and not lifelike to the child but largely rote and mechanical. On the other hand, when a child learns through activities and projects, he acquires his skills and knowledge from a natural

problem and in a lifelike situation. Consequently, the work of the school has meaning to him because it is real and vivid.

These issues are fundamental, as they pertain to the learning and living of the school child. Since the principal purpose of the teacher is to guide the pupil to learn effectively and to live successfully, these issues are vital to the student of educational psychology.

### EXPERIMENTAL RESULTS

Possibly the most extensive study of the project method was made in Missouri in a rural-school situation<sup>(1)</sup>. Three rural schools were included. One, known as the *experimental school*, had an enrollment of 41; two others, known as the *control schools*, had enrollments of 29 and 31 respectively. Over a period of four years, the project and activity program predominated in the experimental school; in the control schools, the traditional methods prevailed, and the object of the experiment was to test the effectiveness of the method stressing purposes and motivation.

In the experimental school, the day was devoted to four types of project: story, hand, play, and excursion. The author's words describe these projects:<sup>1</sup>

Play projects represent those experiences in which the purpose is to engage in such group activities as games, folk dancing, dramatization, or social parties. Excursion projects involve purposeful study of problems connected with environments and activities of people. Story projects include purposes to enjoy the story in its various forms—oral, song, picture, phonograph, or piano. Hand projects represent purposes to express ideas in concrete form—to make a rabbit trap, to prepare cocoa for the school luncheon, or to grow cantaloupes.

The teachers in the experimental school tried to stimulate situations so that these various types of projects grew naturally out of lifelike experiences. For example, the children studied the causes of frequent typhoid fever in the home of Mr. Smith, one of the residents of the school district. They made visits, wrote for bulletins, made flytraps, and prepared reports. This project caused them to do considerable reading, reporting, and writing; they found use for arithmetic in calculating costs for window

<sup>1</sup> COLLINGS, ELLSWORTH: *An Experiment with a Project Curriculum*, p. 48, The Macmillan Company, New York, 1926.

screens and flytraps; and they also had experience in manual training. Thus, as a part of their motivated activity, they received excellent training in oral and written English, arithmetic, manual arts, and sanitation and hygiene. Because they actually studied a real problem and made real recommendations to Mr. Smith on how to avoid typhoid fever, the pupils also developed definite ideals and attitudes toward hygienic and sanitary living.

Many other projects grew out of their immediate environment, such as how Mr. Long made molasses, how the dandelion spreads so rapidly, how tomatoes are canned at the local factory, what will be seen at the big circus and at a trial in a juvenile court and how the county agent tests soil. Out of such projects the grade pupils of this experimental school were expected to obtain the knowledge and skills that are expected to be achieved through the traditional curricula. The exponents of the project method maintain that out of the children's rich experiences they acquire certain ideals and appreciations which probably are more significant to them than are the facts and information that they learn.

The experimental and control schools, which had been matched at the beginning so that valid comparisons could be made at the end of the experimental period, were tested to determine the effectiveness of the project method. The pupils were tested in penmanship, composition, spelling, American history, geography, reading, and the four fundamental processes in arithmetic. The achievement of the students in the experimental school was 138.1 per cent of that of the control school. There is always a danger of fallaciously expressing relative achievement by means of percentages; nevertheless, the results indicated a definite superiority in knowledge and skills of the children taught by the project method.

Apparently, when children are motivated in the study of real and lifelike problems and projects, they acquire more subject matter than do those who study just the teacher's daily assignments. In order to answer their own questions and to solve their problems, pupils of the project method studied in the various subject-matter fields extensively enough to achieve better than those who studied only "the next lesson."

In addition, the attitudes of both pupils and parents toward the school were investigated. That of the pupils was evaluated by calculating changes in attendance, tardiness, truancy, corporal

punishment, graduation from the eighth grade, and the number entering high school. In all these items, distinct superiority existed for the experimental school. For example, 85 per cent of the pupils of the experimental school graduated from the eighth grade, whereas only 10 per cent of the control school pupils did so.

The parents' attitudes were judged by their number of visits to the school, attendance at annual school meetings, rate for maximum teacher levy, use of school apparatus and school library, and votes for establishment of a rural high school. All items were decidedly in favor of the school using the project method. For example, the change in the number of parents visiting school was 90 per cent in the experimental school and 5 per cent for the control.

The evidence from this experiment by Collings is convincing that a type of schoolwork that is motivated and has a purpose felt by the students results in outcomes favorable in terms of both subject matter and attitudes. Mention might be made of the fact that when the effectiveness of any program of teaching or supervision is tested, improved results are usually obtained. This improvement comes about because the experiment causes increased efforts on the part of teachers and supervisors. The experimental program takes on the character of a drive, or campaign, to improve achievement. And experience has shown that achievement can be stimulated when special effort is directed to that end.

Thus, when a method of teaching is tested by experiment, in a sense one is testing also the special effort that takes place when an experiment is preceded and followed by testing. When a method is being tested, more zealotness is devoted to making the method effective. Still, an experiment on testing the results of a project and activity type of teaching gives some evidence on the effectiveness of motives and interests that are developed through this method of teaching.

**Arithmetic.**—The discussion of the activity method can be continued by setting forth the experiences of Harap and Mapes when they taught decimals with an activity program instead of in the usual way(2). Instead of assigning specific problems and drilling on certain facts and principles, they attempted to bring about their acquisition and comprehension by means of 13 units of work. These units comprised the year's work and were

as follows: (1) school banking, (2) keeping spelling records, (3) community fund, (4) using milk, (5) making tooth powder, (6) school fund, (7) making furniture polish, (8) making ink, (9) making hand lotion, (10) making paste, (11) making glacé apples, (12) making presents for mother, (13) making a garden. Through these activities, it was anticipated that the students would acquire a superior knowledge of decimals, and the reader can see how these activities call for a knowledge of decimals. For example, in making furniture polish, the pupils divided and combined various quantities of liquids, such as alcohol, linseed oil, and turpentine, in order to obtain 4-ounce portions of polish. Thus, according to the theory of the activity movement, they learned to understand decimals by making furniture polish and also by engaging in the other activities designed to call into need and practice the use of decimals.

In this experiment, there was an experimental and a control group, and both initial and final tests were given to determine the gain in knowledge over the year's period. The experimental group was taught by means of the units and activities enumerated above; and the control group, in the usual way. Results indicated that in 27 basic processes, the pupils of the activity program gained a mastery of 96 per cent and that the control group, taught in the conventional way, achieved a mastery of 67 per cent. Thus, on the grounds where the activity movement is most severely attacked, the results in this experiment, at least, show that certain narrow and technical skills can be acquired effectively through projects and activities.

Probably of greater importance are the results of the retests given a year after the final tests of the experiment. The pupils of the activity program showed even greater ability than they had at the end of the year's work, indicating that the ability was not only retained but even increased. This is the point emphasized by the exponents of the project method. They state that the skills and abilities acquired when working on real and interesting problems will be retained better because of being learned through use and practice in a situation where the pupils are highly motivated. Knowledge and ability acquired in that way, they claim, will be retained, as it is learned psychologically in a real situation where many rich associations are developed. These educators state that, on the other hand, knowledge acquired



by rote and by teacher-assigned lessons will be largely forgotten, since the subject matter has not the real meaning that it has when learned through activities and experiences. It is contended that true and real meaning is achieved through vivid activities and is not acquired by means of the mechanical and routine procedures of the old-style teaching.

Other experiments also indicate that pupils taught according to the activity method learn very effectively. In one study, the activities consisted of a candy sale, mothers' party, preparing baskets for needy families, preparing a luncheon, making quilts for children's hospitals, and serving the teacher's luncheon(3). Each of these units took from 8 to 12 periods; the purpose was to test whether or not the pupils learned the fundamental processes. Of the 17 processes tested, 14.2 steps, or 84 per cent of them, were mastered. The period covered was half a grade, or one-half year; and an analysis of the examination showed that 79.5 per cent of the basic steps were mastered during that period. The pupils had comparatively little arithmetical ability in the beginning; they acquired most of it during the experimental period.

It did not matter whether the steps appeared logically or in random order; the students learned them just as well one way as another. Furthermore, no correlation existed between the number of times the process was repeated and the degree of mastery; the results in general show that all the processes were acquired to a satisfactory degree.

These results cast doubt on the teachings in arithmetic to the effect that the steps must follow in logical order and that textbooks should make regular provision for consistent review and repetition. Conceivably, if a step is experienced in a problem or activity situation, the usual principles of exercise and repetition do not hold. We have learned that principles of learning through practice and repetition do not hold in many instances and apparently have been oversimplified.

**English and Language.**—Additional evidence on the effectiveness of the activity method was obtained for a semester's work of a fifth-grade class when the activity consisted of writing and presenting a puppet show(4). The pupils gave the show in order to earn money to buy library books, and they made \$26. They studied the history of puppetry in Greece, China, Japan, Italy, India, England, and the United States. They read many books,

trying to obtain suitable material for the construction of their show. Some of these were Andersen's *Fairy Tales*, *Alice's Adventures in Wonderland*, and *Robinson Crusoe*. Oral English was practiced in committee meetings, discussion of plans, telling visitors about the show and how puppets are made, talking to shopkeepers when making purchases, and reading parts in the play. Practice in written English was obtained by writing the play, recording experiences, writing advertisements, letters of invitation, and critical reviews. They wrote to business concerns about needed materials. Activities were not confined to English alone, however. The pupils also had to figure the cost of materials, to sew, to paint, and to do carpentry work. Moreover, they had valuable social experiences from working together, from meeting visitors, and from going to the library.

In this experiment, no control group was used, but tests were given to determine the gains acquired, and comparisons were made with the standards. The percentage of normal, or average, gain in reading vocabulary was 156 per cent; in reading composition, 163 per cent; in language usage, 163 per cent. Thus, the gains in fundamental skills were about one and one-half times the average, and probably most important were the gains from experiences outside the field of English.

**An Early Experiment.**—Even as far back as 25 years ago, a report was made of a grade school in which the students did not study arithmetic, grammar, history, and the other subjects but instead learned through activities which consisted of observation, games, handwork, stories, pictures, and music(5). The pupils thus taught were studied when high-school students, and it was then discovered that they did better on the average than did students taught in the usual way. This, of course, does not prove the superiority of the activity method, because the students from the activity school might have been superior in capacity and consequently might have done superior work regardless of the method employed in teaching them. Nevertheless, the report of this work is important in showing that the activity type of teaching and project method does not belong exclusively to this decade.

**Covering the Material.**—Teachers accustomed only to the usual classroom procedures doubt that the pupils will have an opportunity to acquire fundamental skills and knowledge unless

they are taught in a regular and systematic way. Usually, they ask, "How can a child get his concept of numbers and acquire practice in the fundamental process and also in reasoning with numbers unless he acquires skills and abilities through formal drill?" They do not realize that a method can exist outside the regular drill-and-assignment, textbook method.

Nothing is farther from experience than this assumption however, as students from kindergarten through graduate school learn by means of problems and activities that cause them to acquire many facts and develop new ideas. In fact, in the graduate school, a student learns largely through working on problems and conducting research. In the kindergarten, children can learn arithmetic by using the calendar and raising questions about various days, by keeping attendance charts, by keeping track of vacation days, and by holding parties for their mothers(6). Any number of situations arise where children attending school can learn numerals and ordinals much more effectively than through formal drill and teaching.

In this connection, reference may be made to a study conducted to determine the origin of activities and the courses or subjects involved(7). Teachers of Berkeley, Calif., were asked to indicate the subjects in which activities originated; those which became involved in addition to those in which the project originated; the length of time covered by the activity; and whether the activity was initiated by the pupils or by the teachers. Other points were covered also. Most activities originated in the social studies, and about one-fourth as many in reading and nearly the same number in nature study as in reading. Thus, it is apparent that far more activities originate in social studies, and fewer in the others.

Of the subjects involved but in which the activity did not originate, art was involved most, with reading and language nearly as much, and spelling only one-half as much as art. Other subjects were included less than spelling.

Activities vary considerably in their length, some taking a whole semester, others eight weeks, some four, and others a still shorter time. It is quite apparent, therefore, that activities fit into some fields of study better than in others, and possibly it is not safe to depend on activities to cover all the so-called *fundamental* subject matter. The proponents of the activity move-

ment, however, might argue that the curriculum should not be divided into subjects and that projects and activities that disregard subject-matter lines will cover all fields of learning in the elementary school very adequately.

Another analysis to determine whether or not the processes were covered by activities was made to determine how many involving the adding of tenths, hundredths, thousandths, and various mixed decimals were made(8). It was evident from this analysis that most of the steps involving the processes mentioned and also various combinations of decimals used in multiplication, subtraction, addition, and division were used. In one unit, for example, 34 out of 47 steps were practiced; and in another, 26 out of 47. It appears, therefore, that if several activities or projects are carried out, practically all the steps will be covered.

**Postponing Formal Arithmetic.**—One of the most fascinating experiments reported in the literature was one pertaining to the examination of pupils in arithmetic and the subsequent postponement of formal arithmetic until the seventh grade(9). This experiment was not scientific in the usual sense, because it did not have a control and experimental group; nevertheless, it is so full of ideas that it is worth detailed consideration. Benezet was disturbed by the large number of failures in the first grade because of arithmetic; in addition, he was appalled by the answers that eighth-grade pupils gave to his questions. A stenographer reported the replies. To a question about fractions, he received some of the following replies:

1. The smaller number in fractions is always the largest.
2. If the numerators are both the same, and the denominators one is smaller than one, the one that is the smaller is the larger.
3. The denominator that is smallest is the largest.
4. If you have two fractions and the one fraction has the smallest number at the bottom, it is cut into pieces, and one has more pieces. If the two fractions are equal, the bottom number was smaller than what the other one in the other fraction. The smallest one has the largest number of pieces—would have the smallest number of pieces, but they would be larger than what the ones that were cut into more pieces.

The English used by the pupils was astounding; the knowledge of arithmetic was no better. As a consequence, Benezet stated

that he "abandoned all formal instruction in arithmetic below the seventh grade and concentrated on teaching the children to read, to reason, and to recite—my new three R's!"

The new plan was carried out where the parents did not speak English; if it had been tried in schools where the children's parents were high-school and college graduates, there might have been a revolution. "Educated" parents would not have permitted such a drastic change in the school program, but the foreign speaking were less sensitive. In the first six grades, the program was informal but directed to give students quantitative concepts and to stimulate quantitative thinking. In the first grade, for example, the pupils learned the numbers up to 100 and such comparative terms as *more, less; many, few; higher, lower; taller, shorter*. In the second grade, the comparatives were continued; but pupils learned also how to tell time, page numbers, values of certain coins, and such simple measures as pint and quart. In grade four, for example, they did considerable estimating of dimensions in terms of inches, feet, and yards, and they also estimated distances in terms of miles. In all this informal work, an attempt was made to stimulate the students to reason soundly, judge accurately, and comprehend matters realistically rather than mechanically.

The members of both the conventional and the experimental classes were also asked to put down what they were inspired to write when a picture of a polar bear on a small iceberg was hung before them. It was Benezet's theory that formal arithmetic resulted in unimaginative expressions and stifled the power of expression. He found that, in the classes where the arithmetic was informal, the pupils were distinctly superior in their use of adjectives. They used such words as *magnificent, awe-inspiring, unique, and majestic*, whereas the students in the classroom where they had formal arithmetic used such words as *nice, pretty, blue, green, and cold*. Of course, this is not quantitative experimental truth, but it is a definite straw in the wind, showing possibly the direction in which the evidence points.

After a period of time, the formal and informal classes were visited again and given a problem such as this: A wooden pole is stuck in the mud of a pond; one-half the pole is in the mud, two-thirds of the rest is in the water, and 1 foot is sticking out in the air; how long is the pole? In the traditional classrooms,

the answers were as incoherent as those of which samples have been presented here; figuratively speaking, the pupils themselves were stuck in the mud. On the other hand, the students in the classes where formal arithmetic was postponed to the upper grades figured out the answers without any difficulty; and when the answers of five years before were read to them, they shouted with laughter.

It can be argued, of course, that the type of arithmetic problem used is the old type which is now out of date. In addition, as has been said before, claim may be made that the procedures were of an observational nature and did not involve carefully controlled measurements. That is true, of course; nevertheless, this type of study has considerable value because of the ideas that it emphasizes.

Not all the evidence of the project method of teaching indicates that this method is most effective(10). In the following investigation, a nature-study project was used in grade 2A; an arithmetic project in grade 4A; and a geography project in grade 8A. Certain criteria were set up for projects, such as that the activity should be pupil-directed, there was to be no drill, recitation, or review in the conventional meaning of those terms, and the teacher in general was to be a guide and counselor. The control groups were taught in the usual way, and tests were given to both groups to measure the achievement in the fields covered by the projects. The tests revealed that the control group was consistently ahead of the project group, having made gains more than twice as great and, in some instances, more than three times as great. The teachers felt, however, that the project, or activity, method aroused more interest, increased the amount of reading, stimulated pupils to more oral expression, and made greater use of pupils' personal experiences.

In evaluating the effectiveness of any teaching method in terms of what children learn, it should be kept in mind that the teachers who use the method are also being tested. It is possible that the teachers in some instances use one method much more effectively than another. Not because of any inherent advantages in the method, but rather because of the teachers' ability to use it, advantages are found for almost any method by its advocates. Those who are exponents of a system of teaching have a zeal for it that results in superior achievement. Therefore, in weigh-

ing the merits of any method, this factor should be taken into account in the final summing up.

### SUMMARY

The traditional formal type of teaching places emphasis on good assignments and skillful questioning on the part of the teacher, and the major sources of information are the textbook and the teacher. In the more informal type of teaching, learning is stimulated through activities and projects, with the teacher guiding the learning and helping whenever she is needed.

Evidence indicates that pupils can learn more effectively through the more informal method, but there is some evidence that in certain instances they do not. Considerably more evidence could have been given showing instances where the traditional methods are more effective; but that was not necessary, as it was enough to illustrate teaching methods based on motive and interest to induce effective learning. If the more informal methods minimize rote learning and bring more meaning into the processes of education, then they make their greatest contribution in that way.

The experiments presented illustrate how subject matter is covered and how pupils learn through projects and activities. By means of excursions, plays, sales, making various articles, and working on other real problems, subject matter in various fields is learned both directly and by studying matters related to the problems at hand. In this connection, we use the terms *primary*, *associate*, and *concomitant*.

### Problems and Exercises

1. What psychological principles are involved in the formal, traditional method of teaching and also in the more informal, progressive type? Contrast the two methods.
2. Give an illustration of learning according to each method.
3. What are the main facts in the Collings experiment?
4. Give an illustration of how you have learned effectively through natural, lifelike situations?
5. What criticisms, either favorable or unfavorable, do you wish to make of Benezet's investigation?
6. What effect on the pupils' power to think effectively have the classroom methods which involve materials and concepts which the pupils are not mature enough to grasp?

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## CHAPTER XIX

### MEASURING THE LEARNING AND ACHIEVEMENT OF PUPILS

#### SCHOOL MARKS

**Directions for Study.**—In this chapter, special attention is paid to school marks; note that the standards for marking vary for different circumstances and that school marks do not have a consistent meaning.

Considerable discussion centers on what marks should represent, because they represent so many different things to different teachers. Note the variability from teacher to teacher, department to department, and school to school.

School marks are important and, consequently, should be arrived at accurately. The reader should study carefully what is meant by the standard, or normal, distribution.

What are the advantages of having a standard distribution?

A number of arguments are given against the present extensive marking system. Note those objections.

A system is described that places less emphasis on the usual large number of marks and more on describing the adjustment that the child is making in the school situations. Note the characteristics of the modified marking system.

**Introduction.**—A phase of education that weighs heavily on both teachers and pupils centers on school marks. Teachers spend an enormous amount of time and energy in marking the achievement of their students, who are seriously concerned about marks, all the way from the kindergarten through the graduate school. The teachers arrive at their marks according to more or less clearly defined educational and psychological principles, and the students react to those which they receive with feelings that range along the whole emotional scale from greatest satisfaction to the impulse to commit suicide.

A few weeks after sending in the semester marks, a university professor received the following letter from a member of a class

that had consisted of school teachers in service. The letter is presented here because it raises several questions about principles and standards of marking.

DEAR SIR:

Some day when you have a bit of leisure, will you please tell me precisely what one must do or leave undone to earn an A in your courses? I was valedictorian of my high-school class and a special honor graduate from \_\_\_\_ Normal, so it piques me to draw tepid B's—especially in courses on which I devote as much time and work as I did for yours. Perhaps you can suggest more efficient methods for organizing the vast amount of reference material you submit.

But, after all, how did you judge the extent of my knowledge in the course in Mental Tests? I know you approve the modern clamor for attention, but it's a bit unfair to those who, like myself, are by nature reticent, especially in classes where obvious deference is paid to certain gray hairs and, paradoxically, to effeminate, eighteenth century fidgeting. It seems I must join the gushers to draw the A's—those spouters who think any kind of talk goes as long as it is sufficiently vacuous and irrelevant; who boast of their open minds, when as a matter of fact, they are often merely vacant. Yes, silence is golden, but frequently the gold goes to those who have brass enough to speak up. Then, again, your distribution of marks may be based on economics, which, according to *Mercury*, knows no right or wrong.

I know, too, that you objected, to the point of sarcasm (for which, I learned from Professor \_\_\_\_, the classroom is no place), to my being late for two or three classes—but how could I know when you would be on time? Waiting for dilatory instructors is the favorite enemy of my Viking disposition.

Call this rationalizing or what you will; I thank you for any help you can give me.

Yours expectantly,

It may be said in the vernacular that this student put her instructor "on the spot."

Students have a right to know on what basis their marks are determined. The writer of the quoted letter implies that, at least in one instructor's courses, activity in class, deference to the instructor, promptness in arriving at class, and sarcastic expressions influenced her mark. What should be the standard for determining the grades<sup>1</sup> that pupils are given by their teachers?

<sup>1</sup> Possibly the term *grades* should be reserved for indicating the school grades 4, 8, 10, etc., that a pupil is in; and the term *mark* for indicating the

Should they be based on the efforts and earnestness of the students, their mental capacity, good or bad behavior, or achievement and accomplishment or on other factors? In view of the many conditions influencing teachers in grading students, almost as many different standards exist for determining school marks as there are teachers.

**Standards for Marking.**—To illustrate this topic, reference will be made to a certain man's response to his son's achievement in arithmetic. This father had obtained some standardized arithmetic tests which he gave to his son, thereby discovering that the boy was below the standard for his grade. The man recalled seeing on his son's report card A's in arithmetic. The inconsistency between his son's achievement on the standardized test and the mark on his report card caused the father to do what some interested parents do when certain questions come up—go to see the teacher.

He explained to the teacher that he had discovered by means of arithmetic tests that his son did not know so much as she had indicated by the A's on his report card. She admitted that his son was not the best pupil in arithmetic; there were several who were better, but she emphasized the fact that no boy in class was a better citizen, tried harder, was prompter in handing in his work, or showed a better attitude.

The father replied, "My chest swells more with the pride of knowing those facts about my son than it would if he were the best in arithmetic, but you have been fooling me. You have been telling me by those A's on my boy's report card that he is excellent in arithmetic; and now I find out that, as a matter of fact, he isn't."

The marks in a subject should have a reliable meaning; they should represent a student's achievement in that subject—his status in terms of knowledge, ability, skill, or accomplishment in it. An A in geography should represent that quality of attainment in geography. The highest marks should be given to those who have satisfactorily demonstrated the greatest superiority, and the lowest to those who show that they are least proficient. Those between the best and poorest should be distributed accord-

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quality of a lesson or the work of a period or semester. Grade and mark have such extensive use as synonyms, however, that they will be used so here.

ing to the degree of excellence between the two extremes of achievement.

Many teachers will protest that some students try hard and should be rewarded for their efforts. They argue that if the sincere, industrious students of low capacity get grades determined by their ability in a subject, they will be discouraged and lose interest; their valuable trait of perseverance will thus be destroyed. Other teachers insist on grading according to the improvement that individual pupils have made in their subjects: A pupil who is only average at the beginning of the year but improves his position so that he becomes one of the better ones deserves a high mark. Similarly, if a pupil starts at a low level of achievement according to the standard of the class and works himself up to the average, he also deserves a good mark.

All these points of view have validity. Attention should be given to the development of desirable traits and the prevention and discouragement of undesirable ones. The teacher who thus has the development of the pupil's personality in mind is to be commended. Still, there should be a better way of accomplishing that purpose than making a mark for a given subject a composite of varying proportions of achievement, improvement, initiative, effort, attitude, regularity of attendance, etc.

The way to avoid making a mark in any subject a conglomerate symbol of achievement and various degrees of other excellences is to rate achievement and the other traits separately. The mark in history, for example, should represent attainment in that subject; and the other traits should be rated individually. If teachers of a school system wish to judge their students according to their growth in a subject, their industry, activity in class, initiative, and any other qualities, they should make separate items on the report card and rate the pupils in those traits as carefully as possible. By that plan, the several ratings and opinions of the teacher are recorded separately and not merged in a mark whose meaning may be misleading.

**Variability in Marks among Teachers.**—Another source of unreliability in grading is found in the uncertain standards of the individual teacher. An A, for example, obtained from one teacher may not represent the same degree of attainment as an A from another. Furthermore, the mark that the teacher gives may be based on standards different from those determining the

same mark for another student. From time to time, teachers differ in their evaluations of a certain pupil's themes, arithmetic papers, drawings, and examinations. If, for instance, a large group of typical English teachers should rate the same theme, a few would probably mark it a failure, a few would mark it superior, though the great majority would give the theme approximately the same rating.

The great variability in the marking method of any one teacher has been established by a number of investigations. Variability in marking standards characterizes teachers of all subjects. Arithmetic teachers, for instance, may say that they know how to mark their papers because arithmetic is exact and precise. Investigation has shown, however, that teachers differ as much in their evaluation of an arithmetic lesson as they do in evaluating almost any other subject.

Briefly reviewed are several studies by Rinsland,<sup>1</sup> which indicate that teachers differ in marking papers and that their marks are unreliable. A paper in English was marked by 142 teachers, and the marks ranged from 50 to 98 per cent. When 114 teachers marked a geometry paper, the range was from 28 to 92 per cent. Similar variation was characteristic of the marks given history and arithmetic lessons also.

Furthermore, students soon learn that teachers differ among themselves in their marking. They learn that some teachers are easy markers and others hard. The general characteristics of their grading methods are soon learned; and in high school and college, where students may elect subjects, they take into account their likelihood of getting a good grade by virtue of the instructor's standards of marking.

By turning in themes or drawings that have been used before, students have learned that instructors are inconsistent in their marking. Students have discovered from experience that a theme, for instance, that has been marked and returned may be submitted in corrected form by another student at another time and get a lower mark than it received originally. A student removed the mark from a drawing of goldenrod made by a student in the class the previous year and submitted it again. Receiving a lower rating on it than the other student had received,

<sup>1</sup> RINSLAND, HENRY D., *Constructing Tests and Grading*, pp. 2-11, Prentice-Hall, Inc., New York, 1937.

he remarked, "Teacher must have been suffering from her hay fever when she marked the goldenrod this year." Such incidents do not increase student respect for the justness and reliability of marks.

**Variability among Departments.**—Standards vary not only with individual teachers but also with departments. The proportion of the various marks A, B, C, etc., or their equivalents differs considerably in the departments of the same school. In some schools, it is easier to get a good mark in the social sciences than in mathematics. In others, the language departments give fewer good marks than any other department gives. Under such conditions, the interpretation of grades by any reasonably consistent standard is practically impossible.

Differences among subject-matter fields and departments are found also in high schools and colleges. In one college, for example, 20 per cent of the students were failed in the mathematics department, whereas in religious education less than 2 per cent failed. In the same university, 45 per cent of the students got A in art, and only 7 per cent received A in psychology. Someone, on seeing the distribution of marks for the various departments, suggested that the football coach should have this information in order to keep his players eligible.

**Variation from School to School.**—Schools, too, differ among themselves in the percentages of the various marks that they give. Some give more marks indicating superior achievement than do others; likewise, some give more representing inferior attainment.

Of greater significance is the fact, based in part on variation in marking students, that a mark earned in one high school or college does not indicate the same absolute standard of achievement as a mark earned in another similar school. For example, superior achievement in some colleges is hardly equal to inferior achievement in others. Correspondingly, a student will fail in one college, whereas in another a student with the same quality of work may be regarded as average.

The example of Miss C., who received very high marks in one school and only average grades in another, is a case in point. She received excellent marks in a college that she had attended for three years and where she was regarded as one of the best students. Transferring to another for her senior year, no matter how hard she tried she failed to achieve more than an average

mark. In the examinations, which were objective, so many scored higher than she that her position was always about average or below.

The emotional effects of her experience were extremely depressing. Accustomed previously to being a leading student, she now acquired the attitude of defeatism. She surmised, correctly perhaps, that she would be unable to do graduate work and consequently felt that a barrier had been raised against her. The good school marks that she had received in a school where the standards were low misled her into believing that she was capable of succeeding in any school. The variation among schools in the true meaning of marks misleads many students.

Marks of one college represent a standard of accomplishment different from that of another, partly, no doubt, because of variation in marking standards but probably to a greater extent because of the differences in the quality of the students. In some colleges, the poorest quarter of the students are as good as the best quarter in another. Thus, the better marks in the one institution really represent no more achievement than the poorer in another. Many who receive a diploma in one college would fail or, at best, do poorly in another. The dullest high-school graduates with adequate resources to pay their tuition and support themselves could discover some college where most of them would be able to obtain a college diploma. The quality of the student body in some colleges is so low that almost anyone can get passing marks.

Here, then, is a situation among individual teachers, departments, schools, and colleges where marks vary to such an extent that it is hard to tell what they mean. The teacher can scarcely be confident that the mark he records on a paper or report card is a valid rating of achievement. Unusual is the teacher who can say that his marks have definite meanings in terms of certain conditions. An attempt will be made in the following pages to explain certain definite standards for determining marks; but first of all, the importance of marks will be discussed.

**Importance of Marks.**—Probably nothing else that a teacher does is regarded so seriously as the marks by which she evaluates lessons and those which she records on report cards. Many of her pupils work for and live by those marks; some are seriously depressed and discouraged by them; others, elated and stimu-

lated; occasionally, children are indifferent to them. Even if their children do not, parents often take school marks seriously. They view the school and their children through the report card. Because most children and parents both take the report card seriously, the marks recorded on it should be as true and reliable as it is possible to make them.

Marks are important also because they determine failure and promotion in school. Surely, at times, teachers have failed some pupils who actually were better in achievement than others who were promoted. The teacher has an important responsibility when she determines who shall and who shall not pass.

School marks are used, moreover, to decide who shall receive honors and scholarships. Many schools have various honorary societies in which qualification for membership depends chiefly on high marks. In college, membership in Phi Beta Kappa and the privilege of wearing its coveted key is determined largely by marks obtained in college courses. In some colleges, students receive extra honor points for superior marks, and thus they are enabled to reduce the number of courses that they must take; they earn quality credits for excellent work. Valedictorians and salutatorians are those who have received the highest marks. Nearly all the honors and distinctions accorded students in school are given to those with high marks. Occasionally other factors, such as general all-round development, are taken into account in conferring these honors, but the student's marks are usually given most consideration.

Some groups believe that no relationship exists between scholastic success and success in postschool life and that, therefore, school marks are without significance. They assert that those who were excellent students in school do no better during their adulthood than do those whom the teachers considered poor. Editorial writers in many of our papers delight in pointing out the man who did not do well in school but is a noteworthy success in life, especially at accumulating wealth. The editorials often lead us to conclude that the way to succeed in adulthood is to fail in school during childhood, for to do exceptionally well as indicated by the teacher's marks is to insure failure in postschool days.

As a matter of fact, those who succeed in school tend also to succeed in their vocations. In other words, a marked relation-



ship exists between the quality of scholarship and the effectiveness of the adjustment that is made in later life. Marks thus help to predict who will make the best adjustment when school days are over, as they serve to discover those successful in school. The traits that make for success in school do tend to make for success in adult life, despite popular opinion to the contrary.

Moreover, school marks play an important part in recommendations for some positions. The student who is planning to teach will find it easier to obtain a position if his record contains good marks rather than poor ones. Large law corporations employ law graduates with the best scholastic records. Hospitals select, where possible, the best medical students to be internes. Marks are thus held to indicate in a general way the amount or extent of certain desirable qualities.

Marks, then, to repeat, are exceedingly important. No doubt, some people attach more importance to them than is warranted. Probably our educational methods would be improved if we minimized that emphasis by giving more general marks and thus recognizing the unreliability inherent in ratings of students by individual teachers. Still, because even necessary changes are often made very slowly, it must be recognized that teachers will probably be giving marks for a long time to come. Consequently, it is well to have some principles in mind for guidance in methods of marking.

**A Symmetrical Distribution of Marks as a Guide in Preventing Unwarranted Variation in Marking Standards.**—A few days before an instructor gave the final examination in his course, he told the class that he would allot the marks so that they would make a balanced distribution. Thus, he stated, 10 per cent would receive A, and 10 per cent would receive F; 20 per cent B, and 20 per cent D; and 40 per cent would receive C. In other words, the distribution of marks was as follows:

|               |    |    |    |    |    |
|---------------|----|----|----|----|----|
| Mark.....     | A  | B  | C  | D  | F  |
| Per cent..... | 10 | 20 | 40 | 20 | 10 |

This distribution is a symmetrical one. Most of the grouping is around the average, and the extremes are balanced. The students, of course, were upset by this predetermined distribution of marks, because many of them visualized themselves as

being included in the 30 per cent who were destined to receive D's and F's.

The general theory, or principle, underlying the symmetrical distribution of marks is the assumption that the achievement of students is distributed in that manner. Consistent with that assumption, the marks representing the quality of achievement should be distributed symmetrically also. Consequently, the number of A's and F's are equal, a large number of B's are equal to the D's, and the C's are the largest in number.

Psychologists, educators, and students, too, have opposed for a number of reasons the general and indiscriminate application of the normal, or symmetrical, curve. It may be objected that the average of each and every class is not C and that a fixed percentage should receive C's, with a fixed but smaller percentage receiving B's and D's and with a fixed but smallest percentage receiving A's and F's. Possibly, on the average, such a principle is correct, but classes vary in the quality of the students attracted to them, and no blanket scale is suitable. Selective forces operate to bring superior students into some classes and inferior students into others.

Then, too, the instruction is better in some classes than in others. Some particularly able teachers are so effective that their students achieve more than do the pupils of others. In such instances, more of the better marks should be given to the members of those classes which achieve more than to those whose achievement reflects poorer instruction.

Another point pertains to marking the students of various ability levels in terms of those ability levels or according to the same standard or an absolute one. If the same standard is maintained for all students, then the dull are competing with the bright and can rarely, if ever, achieve the higher marks. If marked according to the standards of their own ability, the weaker students will receive the usual proportions of the various marks, as will the average and brighter students also. Then the marks of each ability level will not mean the same; A's earned by the dull will not represent the standard of achievement that such a mark represents for the bright; and correspondingly for the other marks. When using the marks for guidance purposes, teachers and administrators will need to interpret them in terms of ability levels.

Those who make the point that the normal curve should not be applied without taking several factors into consideration are on solid ground. If the principle of the normal curve is applied to all classes indiscriminately, the distribution of marks of every instructor will be the same, but the marks will not have the same meaning. As has been said, classes vary tremendously in their capacity for achievement and also in the quality of instruction that they have received. If every instructor gives the same proportion of A's, B's, C's, etc., then an A of one instructor will not represent a degree of achievement corresponding to the A of another. Similarly with the other marks. For a very superior class will get the same distribution of marks as a very poor class.

The strict application of the principle of normal curve to the marks of a given department may result, therefore, in an injustice to the students. Reference has been made in this chapter to an art department of one particular university where about 45 per cent of the students got A's. In this department, about 90 per cent received A's and B's. When the dean noticed the unusually large proportion of high marks in the one department, he was disturbed and asked for an explanation. The head of the department pointed out that the number of students taking art courses is relatively small and includes mainly those who are interested and have special talent in art. In other words, the art students are a selected group for art ability. Furthermore, because 12 per cent of the students drop out before finishing, the poorest ones are lost. Only the best art students remain and are marked. Such is not the case in the mathematics and English departments, for instance, where students of all degrees of aptitude are found.

Possibly the department chairman stressed the selective character of her students a little too much, but one can be certain that she was right in principle. If a teacher gives better marks, as the art teachers did in this instance, because he feels that he has a superior class, he should have definite evidence that his students are superior. He should know, from their marks in other courses, from mental-test results, and from their special aptitudes whether they are a superior, average, or inferior group. Often one's personal judgment of a class is not substantiated by the objective results.

**A Standard Distribution of Marks as a General Guide.**—The teachers of a school may decide that they should be guided in general by a standard distribution of marks. The following are sample distributions showing the percentage of each mark; any one of these might be adopted, or any other standard devised.

|   | A  | B  | C  | D  | F  |
|---|----|----|----|----|----|
| 1 | 10 | 20 | 40 | 20 | 10 |
| 2 | 7  | 24 | 38 | 24 | 7  |
| 3 | 5  | 25 | 40 | 25 | 5  |
| 4 | 5  | 20 | 50 | 20 | 5  |
| 5 | 15 | 25 | 45 | 10 | 5  |
| 6 | 10 | 20 | 50 | 10 | 10 |
| 7 | 15 | 25 | 45 | 15 | 0  |

All these distributions are symmetrical except numbers 5, 6, and 7. Distribution 2 is sometimes regarded as being the normal distribution when five divisions or steps are used. The steps need not always be represented by letters but may include numerical ranges or the percentage system, such as 95–100, 85–94, 70–84, 0–69, or whatever numerical steps one may wish to choose. If a school decides, however, that it will fail no one or very few or have a preponderance of passing grades, it can adopt scheme 7 or one similar to it.

A standard can be serviceable if it is usually observed by the teachers of a school system but disregarded when there is a good reason for doing so, as when a class is definitely superior or inferior. The usefulness and validity of a standard for marking can be illustrated by describing briefly how the superintendent of one school applied a standard. In this school, the children in the third grade received marks so much lower than those which they had got in the second grade that the parents were aroused. They criticized the third-grade teacher so severely that it was necessary to go into the matter.

In order to understand the difficulty, the superintendent studied the marking systems of his teachers. He discovered that the second-grade teacher gave much better marks to the pupils than either the third-grade teacher or the other teachers. It was suggested that they all adopt a common distribution for marking members of the classes in the various subjects. Copies of the

distribution of grades given by each teacher were mimeographed so that they could be compared by the teachers. The second-grade teacher soon distributed her marks in harmony with those of the other teachers and thus corrected the difficulty arising from the large differences in the marks obtained by the pupils in her grade and the grade following.

A school can determine for itself what standard it wishes to observe. The faculty in a college may say that it will observe any one of the schemes listed on page 430. If, for example, it adopted No. 1 as the standard for freshmen, then the instructors would aim to distribute their marks so that of all the freshmen in all their subjects, 10 per cent would receive A's and 10 per cent F's, 20 per cent B's and 20 per cent D's, with the remaining 40 per cent C's. It is doubtful that a college should maintain the same standards for the sophomore, junior, and senior years. It might do so on the decision of the faculty, but it is logical to decrease the proportion of low marks from the freshman to the senior year and increase the number of higher marks correspondingly; for after the first year, the students are a more or less selected group. In the senior year, the percentage of failures should be smallest, because by then many of the weakest students have dropped out.

The experience of a geography teacher illustrates how marks might have been assigned in a balanced manner. She had three sections of students who were given the same assignments, taught similarly, and given the same examinations. When the examinations had been scored and the average for each class calculated, she found that the classes differed in their achievement. She was perplexed as to what proportion of the various marks to give the members of each class and decided to apply the same distribution of marks to each section. By this method there was the same proportion of A's in the poor as in the good section, and the same percentage of F's in the best as in the poorest section. Obviously, here was a faulty use of the principle of normal distribution. According to the method used, the achievement that resulted in a C in the best section resulted in a B and possibly an A in the poorest section. Such inequalities in the marking standards are an injustice to the students.

It would have been sound practice to combine the scores and make one distribution for all three sections. Then those in any

class who received A did so because their achievement was equal to the A work in either of the other groups. Similarly, the A, B, C, D, or F of one section would have represented the same quality of achievement as those marks obtained by the students of any other section.

The problem of grading students and their work is one of the most troublesome but important that the teacher faces. She should consider it with great care and be sure that she has good reason for what she does. Still, a teacher is hardly warranted in having much confidence that the marks that she puts on a lesson or records on the report card are wholly accurate or reliable. For observation and experience have revealed, as stated before, that evaluations of student work differ from teacher to teacher, from department to department, and from school to school. Frequently, the evaluations of even a single teacher will be inconsistent.

Ideally, the mark given in any subject should indicate the degree of achievement or attainment in that subject and nothing else. Other qualities of the students should be marked separately. Teachers, at least within the same school, should attempt to define the basis for their marks so that the mark of one teacher will have the same meaning as that of another. The individual teacher should use a system such that her marks on one day are comparable to those given on another. Applying a standard, such as the normal distribution or some other arbitrary standard, may prove helpful in attaining accuracy; but when it is used, certain factors must be taken into account, especially the quality of the students. The school mark should be made mainly, as far as possible, a reliable indication of the quality of achievement.

#### SHALL WE MODIFY THE PRESENT MARKING SYSTEM?

Marks have been discussed to a considerable extent because of their great importance in most schools. The discussion, however, should not keep us from considering the advisability of minimizing the emphasis that we place on them. Excellent arguments can be offered for modifying or possibly altogether abandoning the conventional marking systems. Some of the evidence, such as the variation of standards and the unreliability in marks, have already been set forth. Such facts are

important, but the effect of marks on the learning process is even more important.

Marks affect the learning process in education by becoming, for the large proportion of the students, the end in education. Those accustomed to D's want C's; the C students want B's; all hope for A's, and a few expect them. Most students discuss the grades that they receive in a course and not the facts and principles included in it. They react emotionally to the grade on a lesson or paper but are, for the most part, indifferent to the content of the lesson itself. Students from kindergarten through the graduate school become primarily seekers for marks and true learners only secondarily, if at all.

Many students are relatively indifferent to the quality of instruction if, in the end, they receive a satisfactory mark. One student said of his teacher, "He is no good as an instructor; but if I get at least a B, I'll be satisfied." Many students evaluate their subjects or courses in terms of the marks that they receive in them. Thus, marks make students comparatively uninterested in learning and education; they are primarily interested in the grading that is made of their work.

The extent to which school marks influence and control the mental life of school children can be illustrated by the case of Esther, a little girl who had spent two years in school, one in the kindergarten and one in the first grade. In the kindergarten, no marks were given. Esther did her work well and showed considerable initiative. She had much freedom and exhibited a lively interest and curiosity. She asked many questions and seemed to be greatly interested. Her attitude changed in the first grade, for there she was marked on almost every bit of work that she did. She would receive a gold star for this, a silver star for that, and a rubber-stamp star for a mediocre lesson. It was not long before she began to work for the different grades of stars. Falling subject to the narrow control that the teacher exercised over her by incessant grading, Esther lost much of the natural curiosity and initiative that had formerly characterized her work. She became a task doer, a lesson getter, because she was trained to ascribe a high value to the marks that the teacher put on the lesson.

Furthermore, the system that involves the continuous rating of the pupil's work by the teacher results in a relationship between

teacher and pupil that is not conducive to the best learning situation. The student does tasks for the teacher, who in turn rates or marks how well she thinks these tasks have been performed. The student asks, "How do you want it done?" or "How long does this paper have to be?" The pupil becomes a performer of set specified tasks for which he wants a good rating. Need we wonder that students fail to do any independent work, that they cease reading and studying as soon as a course or subject has been completed? For most students, with the final grade in a course comes the termination of all effort and interest to learn anything more about that subject.

The relationship of teacher and pupil is further complicated by the fact that marks, instead of being an incentive to learning, become an end in themselves. Instead of a cooperative partnership in which pupils and teachers become interested in their mutual growth and development, the teacher holds the power of marking as a control over the pupil. Many teachers use this power vindictively and give high marks to those whom they like and lower ones to those who are in disfavor. The learning situation would be much better for both pupils and teacher if each ignored marks and worked together on the problems that developed for them in and out of the schoolroom.

Abandoning the great emphasis that is put on school marks would not destroy any desirable incentives. It is true that children need to be stimulated in their learning; and this motivation can be provided, as we shall indicate elsewhere. Here, however, the point to bear in mind is that emphasis on school marks militates against the effectiveness of true and desirable incentives.

The present school plan divides the education of any given individual into numerous subjects; during these periods of study, many marks are given; and at the end, final marks are recorded. Such a procedure is not sound pedagogy. Education becomes divided into bits artificially kept apart, whereas psychologically they belong together. Furthermore, thousands of records are kept of student marks. At the end of every month or six weeks, at the end of every quarter, semester, or term, millions of grades are reported and recorded in the American school system. They are unnecessary. The process is expensive and wasteful in terms of energy and money and doubly wasteful because the



multiplicity of marks is educationally unsound. Fewer marks on larger units of work would be much better. Some think that if we did one-tenth as much marking as we do now, we could mark more effectively.

**Modified Marking Systems.**—Instead of abandoning the conventional marking systems altogether, it would be more practical to modify them. At present, we need to make some report to the pupil and his parents of his responses to school experiences.

In the lower grades, a simple report three or four times a year is adequate. This may consist of a written paragraph describing the child's interests and habits, his special strength and weaknesses, and the general adjustment that he is making in school. The parents should be invited to cooperate with the teacher in effecting the best possible development of the child. No specific ratings are necessary. A simple direct statement of the child's general progress or lack of it is best.

The following is an example of a teacher's written statement about a pupil in the second grade:

Blanche shows good interest in all the school activities except number work. I doubt that we should make much point of this lack of interest, as it may develop when she gets older. We are trying to develop it indirectly, but we cannot force it. Of much more importance is the fact that Blanche has many friends and gets along very well socially.

If a more formal card is wanted—one that contains actual ratings—one can be used that rates the children for their work habits, social habits, and growth. A simple, clear statement should be made about each trait, which can then be marked S, satisfactory; U, unsatisfactory; and I, improvement. Space should be left for a supplementary statement by the teacher if she wishes to make one, and a space for the parent to make one, too. The following is an example:

REPORT CARD SUITABLE FOR LOWER GRADES

|                                                                                     | Fall | Winter | Spring |
|-------------------------------------------------------------------------------------|------|--------|--------|
| <i>Work habits:</i> Shows interest and works diligently..                           | S    | S      | S      |
| <i>Social habits:</i> Gets along with himself and others                            | U    | I      | I      |
| <i>Growth:</i> Expanding in his interest and acquiring new ideas and abilities..... | S    | S      | S      |

ATTENDANCE RECORD

|              | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June |
|--------------|-------|------|------|------|------|------|------|------|-----|------|
| Days absent. |       |      |      |      |      |      |      |      |     |      |
| Times tardy  |       |      |      |      |      |      |      |      |     |      |

## Fall rating:

Teacher's comment: John has shown some temper tantrums and has been unwilling to participate in some of the group projects.

Parent's comment: When he has a tantrum, don't pay any attention to him. Don't urge him to take part in the activities. Possibly if he is neglected, he'll wish to join.

## Winter rating:

Teacher's comment: John is improving. Your suggestions were good ones.

Parent's comment: He seems to like school better, for he doesn't complain about going.

## Spring rating:

Teacher's comment. Altogether, John has had a good year and is now ready for the next grade.

In the grades in which accomplishment in specific subjects is to be rated, the subjects can be marked with the same symbols: S to indicate satisfactory work, U to indicate unsatisfactory achievement, and I to indicate that the work is not marked U because there are hopeful evidences of improvement. There should also be space for teacher's and parent's comment and for marking qualities similar to those named on the cards for the lower grades as has been illustrated.

It is unnecessary and wasteful of time and energy to mark the pupils on their achievement and send home a report card more than three times a year. Furthermore, parents do not need a report every four or six weeks. They know approximately what their children will do on the basis of what they did the previous year. If reports are made only half as frequently as at present, the parents will be sufficiently informed. When necessary, the teacher can send home a report indicating an unfavorable turn

in a child's scholarship. Then parent and teacher can cooperate in order to find the cause of the change and attempt to provide methods for bringing the child's achievement back to its usual level.

In addition, the report card should be made a means for stimulating the child's development. It can be more than a report; it should be one of many educational methods that contribute to the total education of school children. To be sure, though the report cards are greatly simplified and are issued much less frequently, still the teacher's errors in judgment are not entirely removed. Because fine gradings are not attempted, however, unreliability will be minimized, and the marking system will aid in stimulating the educational growth of the child and in guiding him rather than merely indicating his classroom achievement.

### SUMMARY

School marks hold the attention of teachers and students probably more than educational processes and objectives themselves. There are no specific standards for marking, as some teachers mark on achievement largely, and others give credit for attitude, effort, neatness, improvement, and other characteristics. The mark should really represent actual achievement in the subject matter, and these other achievements and traits should be marked separately and not incorporated in the mark indicating achievement in subject matter alone.

Teachers in many instances are not reliable in the marks that they give; they vary a good deal among themselves and fluctuate even in their own marking from time to time.

There are also differences according to subjects studied or departments. In many instances, this variation means that it is easier to get good marks in one department than in another.

Schools, too, have different standards; an A from one is not the same as an A from another. In fact, the higher marks in one institution may represent no higher degree of development in a subject than average or low marks in another.

In spite of these limitations, marks have their value and are of great importance. They are taken into account when awarding scholarships and honors of various kinds. In spite of all that can be said against them, it must still be recognized that they are valuable in predicting success of prospective students

in high school and college. They also indicate to a lesser degree who will succeed in after-school life.

According to a symmetrical distribution, or a normal one, the percentage of A's and F's are equal; B's and D's, a larger proportion, are equal; and the C's are represented by the largest proportion. The purpose of a symmetrical distribution is to cut down the variation from instructor to instructor and department to department. It should not be applied indiscriminately, because some classes may be distinctly higher or lower in ability. A standard distribution, however, may serve as a general guide and in some instances prevent unjustifiable variations.

In altogether too many school situations, the marks become the ends of education and control the teaching and educational methods. Less stress should be put on marks, and more on the learning and development of the pupils. Therefore, a system that brings to the attention of the pupil his strengths and weaknesses with a view to building on the former and overcoming the latter is most desirable. Marks and the report card would contribute more to learning and teaching if they were not issued every six weeks and used to evaluate such a large number of individual subjects and character traits. Because of the foregoing points, the usual marking system is not conducive to the best teaching and learning methods.

### Problems and Exercises

1. Possibly the letter written by an acutely dissatisfied student indicates that our marking system places emphasis on the wrong purposes. Explain.

2. Discuss whether or not teachers are justified, when giving marks for specific subjects, in taking into account the character traits of the pupils.

3. Discuss "easy markers" and "hard markers" in terms of the evidence given in this chapter or any other that you may have.

4. Do you think that it is justifiable for the marks in some departments to be higher than in others?

5. Why is it possible for some students to get reasonably good marks in one school and not in another?

6. What importances are attached to school marks? Give your reaction to them.

7. Give the reasons for using a symmetrical, or normal, distribution of marks.

8. A teacher in defense of the large percentage of high marks that she has given says that she had a very superior class this term. Comment.

9. Give your point of view on the statement that the present emphasis on school marks adversely influences real learning and teaching.

10. What are the advantages and disadvantages in the kind of marking system described and illustrated in the last pages of this chapter?

## CHAPTER XX

### MEASURING THE LEARNING AND ACHIEVEMENT OF PUPILS. EXAMINATIONS AND TESTS

**Directions for Study.**—Discussion centers on the essay, the objective, and the standardized achievement test. Note the characteristics of the essay examination and its advantages and disadvantages; also be able to give the characteristics of the objective test, and compare the two.

In explaining the objective test, the true-false, multiple-choice, matching, completion-and-recall, and classification items are described. Some evidence is presented showing how the examination influences the methods of study; and this point is very significant.

In connection with the topic, standardized achievement test, learn the meaning of the terms, *standard* or *norm*.

Different ages, such as educational ages, chronological age, arithmetic age, and geography age, are discussed. These should be learned.

Various quotients involving these ages are discussed, and they should be comprehended so that their advantages and disadvantages are fully understood.

The examination can serve a number of purposes, and it should be interpreted in terms of those purposes.

**Introduction.**—Practically every teacher, no matter how progressive or what his principles of education, believes in measuring the knowledge and ability of the student in the subjects that he is studying or in the general fields that he is covering. Some teachers believe in frequent quizzes and examinations; others believe that occasional comprehensive examinations are sufficient. Teachers differ in the extent to which they use examinations and in the kind and quality of their tests. Tests differ in their construction and in the accuracy and completeness with which they measure achievement. They fall roughly into two categories: the usual essay, or discussion,

examinations; and the objective, or "new-type," test. These may, of course, take different forms and combinations; nevertheless, each type has its special virtues and weaknesses.

### THE ESSAY EXAMINATION

The essay examination generally consists of 5 to 10 questions. For example, the teacher may ask, "Why is there little rainfall in the area east of and paralleling the Rocky Mountains?" "Why did the colonists revolt against the mother country?" "How do large cities obtain their supplies of water?" "Describe how a bill is made into a state law." Questions of this nature call for explanation and description and usually begin with the words *how*, *why*, *describe*, *explain*, etc. The student is asked to embody his ideas in paragraphs and sometimes in outline.

The student attempts to set forth his answer as effectively as he can, usually keeping in mind the effect that his discussion will have on the teacher. If he knows the material well, he probably writes more than he needs to, because a long answer generally makes a better impression than a short one. If he does not know all the answers to a question, he may introduce additional material, more or less relevant, to pad the answer and thus make it look more impressive.

Students often complain that the questions did not cover all the material that had been discussed. Certain topics that had been included in the daily lessons and that they had studied were not touched by any of the questions. They also add that questions were asked about material that had not been assigned. In other words, the questions did not cover all the material in the course and covered some not included. After the examination is marked and discussed, the same students may discover that they misinterpreted one or more of the questions. They did not realize that the teacher was asking for a particular response. Had they known just what the teacher meant, they would have answered the question satisfactorily. They protest mentally, if not verbally, that they received too little credit for an answer that they think is better than the teacher judged it to be. The individual student may be rationalizing with such arguments; but, on the whole, these objections often have some validity. Factors of inclusiveness, interpretation, and judgment sometimes tend to discredit the essay examination.

**Advantages Claimed for the Essay Examination.**—Certain advantages are claimed for the essay examination. The student is given an opportunity to express himself. Thus he can organize his materials and present them in written form as logically and completely as he is able. He is given an opportunity to evaluate the relative importance of facts and information. In doing so, it is possible for him to exercise judgment in drawing from his fund of information and practice originality in setting forth his ideas. Composition, which gives play to the imagination, initiative, powers of judgment and association, and individuality, may be regarded as valuable.

Ordinarily, the essay examination is not used in a manner that achieves such fine training. Usually, the student is too hurried. He writes as rapidly as he can, putting down the answers that he thinks the teacher wants. From the standpoint of composition, the examination papers are generally bad because they have been so hurriedly and carelessly written. Nor is the student encouraged to exercise his initiative by presenting his own interpretations and bringing to bear on the question supplementary, although not immediately related, facts. He does not have time to weigh facts and organize them. For these reasons, the essay examination as usually conducted does not have all the virtues claimed for it.

Still, it must not be assumed that because the essay examination does not always produce the desired results, those results cannot be obtained. Perhaps if teachers set out to realize the virtues that are attributed to the essay examination, they could do so. If haste and carelessness cause the students to learn bad habits in composition rather than good ones, they should be given more time to devote to careful composition of their answers. They should be told that simple, direct, and accurate presentation of their facts and ideas is best. When the papers are returned, the teacher should discuss the quality of the composition and method of presentation. If the speed element is removed, the essay examination can more adequately test the student's power to present the facts and will tend to acquire the attributes that have been claimed for it. The teacher should stress good style and organization. The questions should be formulated so that the pupil is asked to interpret the facts and evaluate them. If the teacher intelligently works for the



development of interpretation and judgment by means of the essay examination, good results can be achieved.

**Unreliability of the Essay Test.**—It has been proved that the essay test, as usually constructed and administered, is unreliable. More to the point is the fact that those who mark the essay test are not reliable. It is, to be sure, hard for several teachers of a given subject to score the same examination and agree on its value. If they mark it independently, the values that they attach to it will vary considerably.

These objections are justified, but conditions and situations that exist do not necessarily have to exist. They are not inherent in the examination and can be remedied. If they would agree on standards for grading the papers and practice marking them to achieve uniformity in method, the teachers could become more reliable and more consistent in their scoring. They should not only define the standards that guide them in marking papers but should, in addition, inform their pupils of those standards.

We must consider more than the reliability of a test. Its educational validity is most important. An examination teaches the students something. It affects their mental processes and attitudes. It may be so constructed that it trains the students in memory processes only, leading them to spend their time accumulating facts of more or less importance for reporting back at examination time. Their minds are thereby confined to the narrowest limits of scholarship. On the other hand, questions can be phrased so that the pupils are directed to relate facts, apply them to meaningful problems, develop theories and principles, generalize, and speculate. In other words, questions can be thought-provoking. An examination should not, therefore, be evaluated only for the factual information that it measures, but also for the quality of the mental processes that it brings out.

### THE OBJECTIVE EXAMINATION

The objective test is also called the new-type test. As a matter of fact, it really has been used so long now that it can hardly be called new, although it is relatively recent in comparison with the essay examination. Before discussing the psychological value of the objective examination, we shall first describe and illustrate it.

It consists of various types of items or questions, such as the true-false, multiple-choice, matching, completion, best answer, and recall. It is made up of small units of information rather than of topics for discussion. We shall illustrate some of these types with facts from statistics that every student of educational psychology should know.

### True-false.

*Directions:* In the following statements, indicate those which are true by underlining the word *true* and those which are false by underlining the word *false*.

- |                                                                                                          |      |       |
|----------------------------------------------------------------------------------------------------------|------|-------|
| 1. The mean is found by dividing the sum of scores by their number.                                      | True | False |
| 2. The median is the highest score in the distribution.                                                  | True | False |
| 3. The mode is a score or value above which the number of values is equal to the number below.           | True | False |
| 4. Percentiles enable one to describe the position of the scores of a distribution in terms of per cent. | True | False |
| 5. Standard deviation is a measure or unit of variability.                                               | True | False |
| 6. The coefficient of correlation indicates the extent of correlation.                                   | True | False |
| 7. A good sample consists of only the highest scores.                                                    | True | False |
| 8. A considerable number of abilities correlate about .40 or .50.                                        | True | False |

Instead of the two words *True* and *False* at the end of each sentence or preceding it, parentheses can be used. The parentheses, which may precede or follow each statement, should be arranged so that they form a column. A + sign is generally used to indicate that the statement is true, and a 0 or — sign to indicate that the statement is false. Other symbols, such as T and F, can also be used.

Some do not hold the true-false items in such high repute as other forms of objective items, maintaining that they are less reliable; but statistical studies have shown that they are nearly as good as others. Teachers who remember their pedagogy state that a student learns the untrue by reading a false statement. Analysis has shown, however, that the student does not learn the untrue, because he knows that some of the items are not true and, therefore, has the proper mind-set for them.

Great care must be exercised in preparing true-false items. Their preparation is a good exercise in writing clear, simple English. Long sentences containing several clauses may lead to conflicting interpretations. Each statement should, therefore, be a clear expression which is indisputably right or wrong.

The score on a true-false test may be determined as the number right or as the score obtained when the number wrong is subtracted from the number right ( $R - W$ ). Scoring by the rights minus the wrongs ( $R - W$ ) gives a better range of scores for a class and thus provides better differentiation of abilities. The following outline will make clear these facts. Let us assume that there are 100 items in the test.

|                       |     |    |    |    |    |    |
|-----------------------|-----|----|----|----|----|----|
| Number right (R)..... | 100 | 90 | 80 | 70 | 60 | 50 |
| Number wrong (W)..... | 0   | 10 | 20 | 30 | 40 | 50 |
| $R - W$ .....         | 100 | 80 | 60 | 40 | 20 | 0  |

The range of the number right is 50, that is, from 50 to 100. The range of the scores when  $R - W$  is used is 100, that is, from 0 to 100. The latter scores are a better index of the student's ability than the number right. For example, the pupils who get 50 right and 50 wrong may know nothing about the subject, because by chance there would be 50 correct and 50 incorrect answers. The person getting 50 R and 50 W should receive a score of 0, as he does when the W's are subtracted from the R's.

In the case of the pupil who gets 70 right and 30 wrong, it may be assumed that of the 70 correctly answered, 30 of them were answered correctly by chance or guess. The score of 40 represents the number of statements for which the student had the correct answer. Of the other 60, he most likely guessed wrong or had the wrong answer for 30 of them and for the other 30 guessed the right answer. Thus, the net score is 40. It is assumed that of the right answers, the number of them that are right by chance or guess equals the number that are wrong for the same reason.

**Multiple Choice.**—In this type of test, the pupils are usually given four or five items from which to select the correct one. In a sense, this type should be called *single choice*, as one item is chosen from several. The following are examples:

*Directions:* In the following statements underline the correct answer, and write the letter corresponding to it in the parentheses at the right.

1. The mean is a measure of (a) correlation, (b) central tendency, (c) variability, (d) rank, (e) validity. ( )
2. The median is a score of (a) position, (b) range, (c) relationship, (d) reliability, (e) regression. ( )
3. The mode is a score or characteristic that is (a) least frequent, (b) extreme, (c) the seventy-fifth percentile, (d) most common, (e) the twenty-fifth percentile. ( )
4. When the pupil has a percentile rank of 60, (a) he is in the poorest quarter, (b) he is in the best quarter, (c) 60 per cent of the class are above him, (d) he is at the median, (e) 60 per cent of the class are below him. ( )
5. A standard deviation above and below the mean of a normal or nearly normal distribution includes approximately (a) all, (b) one-half, (c) two-thirds, (d) nine-tenths, (e) one-fifth of all the cases. ( )
6. The coefficient of correlation is a measure of (a) relationship, (b) spread, (c) regression, (d) position, (e) central tendency. ( )
7. A good sample is (a) biased, (b) large, (c) small, (d) representative, (e) skewed. ( )
8. Academic abilities generally correlate to the extent of (a) .95, (b) .70, (c) .45, (d) .20, (e) .05. ( )

For the convenience of the scorer, the student is asked to underline the correct answer and to record the number of his answer, or letter as it is in this case, within the parentheses. A paper is much easier to mark and the score is more quickly counted when the answers are in a vertical column than when they are distributed over the paper. Occasionally, the choices in some multiple-choice items have different degrees of correctness, and thus more than one answer may seem satisfactory. But where more than one answer seems acceptable, the more precise one should be selected. In scoring the examination, only the best answer is usually given credit. For example, in the seventh item, which asks what a good sample is, some might regard *large* as an accurate description. *Large* has some merit as an answer, but the best answer is *representative*. To be sure, large samples, on the whole, are better than small ones; but large samples may still be poor, because they may not be representative. One may, for example, test many children and not

tain reliable standards or norms for all, because the children tested were chosen entirely from the better districts or entirely from the poorer ones.

**The Matching Test.**—In this test, the student is asked to match or associate the items in the parallel columns. Because of its nature, it is also called an *association test*. The following is an example:

*Directions:* In the parentheses at the right, place the number of the word from the left-hand column opposite the one in the right-hand column that it most accurately describes.

|                            |                                                    |     |
|----------------------------|----------------------------------------------------|-----|
| 1. Percentile rank         | Relationship                                       | ( ) |
| 2. Mean                    | $\Sigma X/N$                                       | ( ) |
| 3. Median                  | Includes about two-thirds of the cases             | ( ) |
| 4. Mode                    | The middle value                                   | ( ) |
| 5. Range                   | From lowest to highest                             | ( ) |
| 6. Standard deviation      | Measures what it claims to measure                 | ( ) |
| 7. Correlation             | Most common value                                  | ( ) |
| 8. Variability             | Position in terms of per cent                      | ( ) |
| 9. Reliability             | Measures well what it measures                     | ( ) |
| 10. Validity               | $\sqrt{\Sigma fx^2/N}$                             | ( ) |
| 11. Skewness               | Generally the most reliable measure of variability | ( ) |
| 12. I.Q.                   |                                                    |     |
| 13. Frequency distribution |                                                    |     |
| 14. Regression             |                                                    |     |

It is well to have more items in one column than in another; otherwise the pupil can first eliminate those of which he is certain and then guess correctly more of the remaining ones than he can when there are several that are not matched. Another variation is to have two items in the right column that refer to a single phrase. In the sample test given here are two phrases and a formula for item 6. The three items in the right column that are to be associated with standard deviation, or item 6, are (a) includes about two-thirds of the cases and (b) generally the most reliable measure of variability and the formula  $\sqrt{\Sigma fx^2/N}$ . The matching or association test is generally used for names, terms, definitions, dates, titles, etc.

**The Completion Test.**—This test can be devised in different forms or variations, as can most of the other types of objective-test items. The following are examples:

*Directions:* In the column of numbered blank spaces, write the words that make the sentence true. The number in the sentences and the column should correspond.

In a normal distribution, (1), (2), (3) are equal.

The (4) of correlation indicates the extent to which variables are (5), etc.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

The completion test may also be devised so that the answers are included in a column as follows. The object is to select the correct answer and write it in the appropriate blank. This form of the test is called a *controlled-completion test* and has some of the elements of the matching test. The following is an illustration:

*Directions:* In the blank spaces at the right of the page, write down *in order*, for each letter, the number of the word in the left-hand column that is necessary to complete the sentence.

- |                    |                                       |          |
|--------------------|---------------------------------------|----------|
| 1. Normal curve    | In normal distribution, the (a), (b), | a. _____ |
| 2. Mean            | and (c) are equal. The (d) of         | b. _____ |
| 3. Correlation     | correlation indicates the extent to   | c. _____ |
| 4. Median          | which variables are (e).              | d. _____ |
| 5. Related         | A test of perseverance has (f) if it  | e. _____ |
| 6. Coefficient     | actually measures perseverance,       | f. _____ |
| 7. Mode            | etc.                                  | g. _____ |
| 8. Regression      |                                       | h. _____ |
| 9. Validity        |                                       | i. _____ |
| 10. Skewness, etc. |                                       | j. _____ |

In this type of completion exercise, the student selects answers from a list made available to him, thereby avoiding the complications in scoring that arise from the use of synonyms. Some educators may object to this version, on the grounds that, since recognition is easier than recall, the test is providing too many props, that in a sense it is doing much of the student's thinking for him rather than indicating his independent grasp of the

facts in the course. They feel that it may lead him to depend too much on a vague feeling of familiarity with terms. In some cases, however, it is necessary to provide the best possible of terms in order to prevent overlapping of terminology or the complications of alternative answers.

**The Recall Test.**—This test is like a completion test, to the extent that answers must be provided to complete the sentence. The recall test differs in that one or two words are to be recalled for each sentence and are generally to be written in at the end of the sentence. The following four examples are illustrative:

*Directions:* In each sentence, fill in the blank with the word necessary to complete the sentence.

1. When a test measures well that which it measures it is \_\_\_\_\_
2. The distance from the highest to the lowest score is the \_\_\_\_\_
3. The score above and below which the number of scores is equal is the \_\_\_\_\_
4. A systematic organization of the scores according to class intervals is called a \_\_\_\_\_

**The Classification Test.**—The items in this form of test are selected so that in each part all but one of them will fit in with the rest. All but one classify together according to a logical basis, and the one that does not is to be selected, and its letter recorded in the parentheses.

*Directions:* In each of the following groups, all the words except one can be classified together. In the parentheses at the right, place the letter representing the word that does not logically fit in with the others.

1. (a) mean, (b) correlation, (c) median, (d) mode, (e) fiftieth percentile rank. ( )
2. (a) fortieth percentile, (b) median, (c)  $q_1$ , (d)  $q_3$ , (e) standard deviation. ( )
3. (a) correlation, (b) skewness, (c) correspondence, (d) relationship, (e) association. ( )

There are other forms or variations of the types that have been presented, and there are other types of exercises, such as analogies or arrangement of items according to a common quality.

The preparation of a good objective test requires a high order of skill and considerable time. It is necessary to try it out in order to remove unsuitable items and to add others. Even when

a test has been perfected, so to speak, it should not be used for too long a time, for it will tend to fix the course content as well as the teaching method. Examinations should be changed often in order not to retard curricular changes or to routinize the teacher's technique.

A good way to avoid an inordinate amount of work in preparing examinations is for the teacher of a given subject or the department in a school system to keep a card file of examination items. New items should be added to keep pace with new material, and old items removed to a dead file. Alternate forms of items should be filed also. The teacher can then make up relatively fresh examinations with a minimum of labor as the need arises.

Anyone wishing to investigate this subject in greater detail or anyone making a special study of the examination may consult some of the references given at the end of this chapter. In fact, all teachers should make a study of the methods and techniques of the objective examination and should experiment in the construction and use of tests.

#### EVALUATION OF THE OBJECTIVE EXAMINATION

Claims have been made for the objective examination that indicate a tendency to overvalue this newer type and to depreciate unduly the older essay examinations. It is characteristic of those working in education and psychology to overrate the recent innovations and undervalue the older methods. However overemphasized, objective tests do, nevertheless, have some real virtues that justify their use.

**Desirable Features of the Objective Examination.**—This examination handicaps the bluffer, because he is called upon to give precise and definite answers. The objective examination holds the pupil to the point, and he cannot go around it. Though he may wish to interpret the question loosely and write about another aspect, the objective test, by limiting the number of possible answers, does not permit that kind of evasion. It is an excellent device for testing a student's knowledge of the factual elements in a subject. In every course there are certain fundamental facts that the student should learn. The extent of his knowledge of such a body of facts can be better tested by an objective test than by the essay type.



The objective feature of the true-false, matching, completion, and multiple-choice items has real significance. These items can be accurately scored. The score that a student obtains on a comprehensive objective test is, consequently, a reliable index of his factual knowledge in the area tested. It has a definite meaning in terms of the score of other students in the class. The student sees his relative standing and accepts the results of the test. He feels that he has been marked fairly. The instructor, too, can feel more confident of the fairness of his marking standards. The objective test is free from the influence that personal prejudices arising from the pleasant or unpleasant relationship of the pupil and teacher have on school marks.

One of the features that has made the objective type of examination popular is the ease with which it can be scored. By means of lists of answers recorded on cardboard strips or by scoring keys, which fit the column of answers on the examination blanks, the scoring can be done very rapidly. In some tests, the answers may be recorded by the students on small cards, which can be rapidly scored. Then the same examination blanks can be used over and over again, and the scoring can be turned over to a clerk or an assistant. Today, when the government is paying high-school and college boys and girls for work that they do under direction of the schools, part of the work program can be scoring of examinations, as in fact it is in many schools.

The objective test can cover the material of an area or field more completely than the subjective test can. In other words, the objective examination can sample the course materials more thoroughly. Because of the many items in the objective test, no large section of subject matter is omitted. The student can no longer complain that some parts of his preparation were not even touched by the test. The sampling is improved by the variety in the nature of the test forms which give different approaches to the subject matter.

In short, it may be said that the objective test is a reliable measure of achievement. It tests well the extensiveness of the student's knowledge and information. A good basis is thus provided for accurately determining the mark that the pupil has earned.

**Disadvantages of the Objective Test.**—But notwithstanding its advantages, the objective test is deficient in several important

respects. Generally, it is limited to the more factual elements of the course. It stresses the meanings of terms, definitions, opinions, and quantitative materials. All this may be well and good if the examination is limited to facts and information that are significant. Often, unfortunately, it includes details whose educational value almost anyone would question.

In order to keep the test as objective as possible, questions or items are omitted for which no one incontrovertible answer exists. Therefore, some of the best material in literature, history, sociology, and other subjects must be excluded because it is speculative and hypothetical. Whatever is controversial in nature is also omitted, for a satisfactory key can hardly be made for a test when there is doubt about many answers. Consequently, as objective tests are now generally made, the questions are limited to those for which no disagreement can arise about the answer. Furthermore, these tests are better for subjects that are quantitative in nature than for those which are descriptive and involve more speculation and evaluation. The latter subjects require the discussion of facts in their relation to each other rather than the recognition of items in comparative isolation.

The usual objective examination does not provide an opportunity for the student to do independent and original thinking. The feature of this form of examination which keeps the student from bluffing also prevents the good student from speculating and expressing whatever original points of view he might have. The objective examination does not encourage original intellectual explorations by the pupil.

The objective examination causes the student to study in a manner that is not conducive to high scholarship. (The essay examination may be almost as faulty in this respect.) He adjusts his studying to the examination question that he anticipates. In class, he listens to the teacher to note if she says anything that she may later ask; he writes down what he thinks will help him in the examination. When reading, he checks only the items or facts that he thinks will be called for. He becomes a hunter for bits of material. He does not try to coordinate these fragments into a pattern, because that will not help him in his tests. Just before the examination, students frequently gather together to try each other out on numerous more

or less isolated facts that they think will be used. They memorize all sorts of informational bits. Cramming has not been reduced by the objective test but rather has been accentuated by it. Our students are becoming "bit pickers" rather than reasoners, inquirers, and learners.

In an investigation of the effect of type of examination on method of preparation and efficiency in learning, it was discovered that the method of preparation did differ with the characteristics of the examination(1). About three-fourths of the students were conscious of preparing differently for the four types of tests. For true-false and multiple-choice tests, emphasis was placed on rote memory of items and details more or less isolated. In preparation for the essay and completion test or the recall type, more emphasis was placed on the organization and summary of material. The results indicated that a method of study emphasizing organization of material resulted in a better command of the subject as tested by all four types of examination that were used.

These findings point out the dangers lying in the control that examinations can exercise over educational methods and procedures. For example, if examinations of certain types are given state-wide under the auspices of the state board of education or similar sponsorship, they may tend to control both the study habits of the pupils and the teaching methods of the teachers. Examinations on a state-wide basis may be objectionable on several counts; but if they emphasize limited bits of information, scrappy facts, and unrelated details, they are objectionable because they cause teachers to narrow their teaching to relentless drill and the pupils to learn without questioning many bits by rote. Instead of organizing, relating, and evaluating, they store up prospective answers for the examination. Examinations at all levels, from the elementary grades through the graduate school, may either restrict or expand the educational processes. They may cause the thinking processes to be narrowly confined, or they may stimulate originality and creativeness. The results of the different types of examination influence learning in different ways.

The evils are not necessarily inherent in the objective examination any more than the deficiencies attributed to the essay examination are inherent in it. If teachers decide to devise

their examinations so that they stress judgment, analysis, evaluation, and original reactions, many of them can succeed. But to do so is very difficult, a fact that accounts for the make-up of most objective tests and their stress on memory. The thing to bear in mind, however, is not to accept meekly conditions that can be improved but to set about making the desirable changes.

### THE STANDARDIZED ACHIEVEMENT TEST

The standardized achievement test differs from the typical objective test not in form necessarily but in extensiveness. Most standardized achievement tests are designed for grade- and high-school use to measure the pupils' achievement in reading, geography, arithmetic, chemistry, geometry, and other subjects.

Standardized achievement tests are generally given at the end of the year to measure the level of the pupil's achievement in his subjects. His score is compared with the average achievement score for his grade and age; thus, his relative status in various subjects can be determined.

**Standards and Norms.**—Good standardized tests should be constructed so as to include a thorough sampling of the subject matter in history, geography, arithmetic, or whatever the subject is. Furthermore, in its preliminary forms, the test should be given extensively to children who represent a good sampling of all abilities in order to obtain norms, or standards, for pupils of various grades for each of the subjects. For example, the average score of third graders in a reading test would be made the standard, or norm, for that grade. Similarly, the average scores for fourth, fifth, sixth graders, etc., become the norms for those respective grades.

Consequently, a teacher can compare the average score of her grade with the standards to determine if her class measures up to the established subject standards for that grade. In addition, the grade status of the individual pupils can be found from the norms. Some fifth-grade pupils have sixth- and seventh-grade ability or even higher. There will also be some under their norm, equal to only the third and fourth graders; and in a few instances, even lower. It will be discovered that for any given grade some pupils are above and some are below the grade

standard. Occasionally, a teacher will find that her class as a whole is either above or below the norm rather than about equal to it.

Age norms of achievement tests are established for a range of ages in the same way that they are established for grades. The average achievement for eight-year-olds on the preliminary tests is made the norm for that age. In order that the norm may be accurate, the eight-year-olds to whom the test is given must be carefully chosen so that their ability is average eight-year-old ability. If too many bright or too many dull children are chosen, the norm will be either too high or too low. Similarly with other ages, nine, ten, eleven, etc. By means of age norms, one can discover whether or not the pupil is "at age" in his various subjects or the number of years that he is above or below his age in achievement.

There may be several reasons why age and grade norms may not fit the pupils in some schools. It may be that the test does not adequately sample the subject matter of the courses of those schools which include material different from that in the tests. Furthermore, the grade placement of course material may vary from school to school. Those schools which introduce a subject earlier in the course of study are more likely to equal or exceed the norms than the schools that introduce the same material later. A definite tendency exists in some schools, to delay the teaching of certain material, especially lower grade arithmetic. Arithmetic formerly taught in the first and second grade is now being taught in the second, third, and fourth grades. Changes such as these dislocate age and grade norms based on a former grade location of materials. The promotion policy of a school also affects the grade norms and to some extent the age norms. The school that fails a larger proportion of its students will tend to have more capable students in its upper grades than one that passes most of its students. These two schools will vary in their tendency to equal or surpass grade and age norms.

A danger of the standardized test is the effect that it may have on teaching and on school policies. Sometimes, where these tests are in use by many schools, the teacher in an effort to have her class make a good showing directs all her instruction toward preparing her pupils for the examination. She and the students thereby tend to be limited to the content of the tests. Adminis-

trators may be equally guilty in allowing their concern for their schools' high achievement on the standardized examination to "freeze the curriculum" and control subject content for various courses. If they do not stress competitive standing on these tests, the latter will not have a constricting effect on the teaching processes. The learning of the child need not, therefore, be dominated by the standardized test but can be stimulated by it.

**Educational Ages and Quotients.**—We have explained how pupils of a given age may vary in achievement from an age norm far below their age to one far above it. Thus, we have ten-year-olds with the arithmetic ability of average seven-, eight-, nine-, ten-, eleven-, twelve-, thirteen-, and fourteen-year-olds; the range may even be greater. The ten-year-old who is equal in his arithmetic ability to a seven-year-old is said to have an arithmetic age of 7; one that is equal to the average eight-year-olds, an arithmetic age of 8; etc. Comparably, a pupil also has a reading age, history age, geography age, and ages for other subjects. His general educational achievement determines his educational age, which is symbolized by the letters E.A. This E.A. is to general ability in school subjects as M.A. is to general mental ability. E.A. is determined by one's composite achievement in a test of several subjects.

E.A. may be equal to life age or C.A. or may be less or higher. The quotient used to indicate the relationship of E.A. to C.A. is known as the *educational quotient* (E.Q.). It is found by dividing E.A. by C.A. and multiplying by 100, that is,  $E.A./C.A. \times 100$ .\* A child whose E.A. and C.A. are equal has a quotient of 100, which is average. A boy ten years old whose achievement is equal to the average for his age has an E.A. of 10 and an E.Q. of 100, ( $10/10$ ). The E.Q. of a pupil twelve years old who has an E.A. of 9 is  $9/12$ , or 75. An eight-year-old with an E.A. of 10 has an E.Q. of 125, or  $10/8$ . The E.Q. indicates the achievement status of a pupil in terms of the relation of his C.A. to the average for that age.

Quotients can also be calculated for the pupil in each of the various school subjects. By dividing his geography, arithmetic,

\* Although the formula is  $E.Q. = 100 \times E.A./C.A.$ , in general practice here, as in the I.Q., the multiplication by 100 is assumed rather than expressed in the formula. In the cases that follow, the quotients are strictly 1.00 and .75, 1.25, but the decimal point is usually ignored.

history, reading age, etc., by his C.A., a geography quotient, arithmetic quotient, history quotient, reading quotient, etc., will be obtained. The standing of a pupil in various subjects can be compared, and thus his strength and weaknesses observed. Such observation provides an opportunity to help him. If a pupil is particularly strong in history, for instance, special attention may be given to increasing his interest in the subject. Weakness in a subject indicates a need for assistance, but it is scarcely wise to devote so much time to teaching the child in his weak subjects that his strong ones are neglected. That topic has been taken up at some length in other pages.

**Accomplishment Quotient.**—Another quotient used by educators involves E.A. and M.A. It is called the *accomplishment quotient* (A.Q.) and is calculated by dividing the E.A. by the M.A. (E.A./M.A.). Accomplishment is now evaluated in terms of M.A. rather than C.A., as in the case of the educational quotient.

Children are expected to achieve in terms of their mental capacity rather than their age. A twelve-year-old boy with an M.A. of 10 cannot be expected to do so well in his subjects as a boy twelve years old who has an M.A. of 14; and, of course, he rarely will. Theoretically, the achievement of the boy with an M.A. of 14 should correspond to that of average fourteen-year-olds, and correspondingly for the boy who has an M.A. of 10. The A.Q. is intended to indicate whether or not a pupil achieves up to his M.A.

A pupil with an M.A. of 10 should have an achievement age of 10; but if he is more than average in the diligence and the effectiveness with which he studies, he may have an E.A. above 10. If, however, he is indolent or is under average in the effectiveness of his study methods, his E.A. will be less than his M.A.

According to this method, a pupil whose E.A. and M.A. are equal has an A.Q. of 100. The one with an E.A. under his M.A. will have an A.Q. under 100; and he whose E.A. is above his M.A. has an A.Q. above 100. It is assumed that the pupil who has an A.Q. of 100, or approximately that, is achieving what is expected for his mental capacity; one who has an A.Q. above 100 is doing correspondingly better; and one whose A.Q. is below is not living up to his capacity.

By way of summary, it may be said that the general theory behind the A.Q. pertains to achievement in terms of a pupil's capacity. It assumes that capacity for achievement is determined by M.A. as indicated by an intelligence test. Thus, a boy with an M.A. of 12 and an E.A. of 10 or an A.Q. of 83 needs to be spurred on to work harder so that his achievement will approach his mental power to achieve. The A.Q. can be calculated for individual subjects also, and diagnosis of potential capacity made on the subject basis.

**Deficiencies in the Accomplishment Quotient.**—Superficially, these concepts are good enough. They seem sound and have a scientific flavor. We apparently have a means of determining by measurement whether or not students work up to their capacities, and we should adjust ourselves to individual differences by expecting that each pupil work only up to his capacity.

Actually, however, the A.Q. is not sound and does not work out in practice. In the first place, the A.Q. is a ratio with a numerator and a denominator. An error will nearly always occur in each, most frequently small but sometimes large. If the errors in the E.A. and the M.A. are fairly large and in opposite directions, the A.Q. will be badly in error. For instance, if the true A.Q. =  $\frac{3}{4}$ , or 114, but the obtained E.A. is 7 and the obtained M.A. is 8, then the A.Q. becomes  $\frac{7}{8}$ , or 88. The A.Q. has been changed 26 points by the opposite change of E.A. and M.A. of only one year. Errors of one sort and another and even those due to the unreliability of the tests cause the A.Q. to be an inaccurate measure of the achievement of individual pupils according to capacity. The A.Q. is a more dependable measure for groups; but there, too, it is not entirely satisfactory.

Another deficiency of the A.Q. is the fact that it favors the dull pupil and penalizes the bright ones. For example, the A.Q.'s of dull twelve-year-olds with a mental age of 10 will be higher than the A.Q.'s of bright twelve-year-olds with an M.A. of 15. According to the theory of the A.Q., the dull twelve-year-old has to work up to an M.A. of 10, but the bright pupil has to work up to an M.A. of 15. The bright boy has hardly had an opportunity in school to bring up his achievement proportionately, for promotions are, on the most part, made not according to M.A. but according to C.A.

The point may become clearer if we take two boys of the same M.A. John and Richard both have an M.A. of 10, but their



C.A.'s are 8 and 12, respectively. Though the eight-year-old is bright and the twelve-year-old is dull, they have the same M.A. Yet because the younger boy has been in school four years less than the twelve-year-old boy, he consequently has not had an opportunity, as the educational system now functions, to bring up his achievement to the same level as that of the duller boy.

There are other conditions also that prevent the A.Q. from realizing the purposes that some writers ascribe to it. The A.Q. is very undependable, and its apparent virtues are destroyed because of the variation of several factors—tests, school curriculum, and promotional policies—on which its validity is based. Nevertheless, it is well to know about the A.Q. if only because it has been seriously set forth as an index to achievement according to capacity. Because of its deficiencies, however, it does not deserve wide application. The principles that prompted so much interest in the A.Q., on the other hand, are fundamental, and we should work toward their attainment.

#### THE EXAMINATION AND EDUCATION

It is generally maintained that the examination, whether objective or subjective, is an instrument for measuring the pupil's learning and achievement in his school subjects; and the value of an examination is generally analyzed from that point of view. The examination, however, may turn out to be more than that. It may operate in a number of ways and does much to shape the nature of the education that a child receives(2). First of all, it can be used as a whip to make the pupil do his work. The test is given to check on how carefully he has done it. He is thus trained to work for examination results.

When the student asks the teacher, "Shall we need to know this for the examination?" we have evidence of the control that the examination has over the pupil. For example, a teacher in expanding a point deviated a considerable distance from it. A boy in the class raised his hand and said, "What has that got to do with the entrance examination?" It is true that one should not regularly meander far off into the remotely illustrative or speculative, but a system of examination that holds pupils and teacher to a very narrow course is not good educationally.

Again, the examination may be used to measure achievement, to indicate the proficiency of the student and the quality of his

scholarship. The test results may be used to guide the student in his school career and are, therefore, useful in a practical way. As a guide, the examination is an important instrument, but it should not be used too often. Carefully devised comprehensive examinations given once a year, or even at the end of the elementary school or high school, will adequately determine the achievement status of individual pupils. Such an examination, requiring several hours, will serve as a better index to what the pupil has learned than all the marks on his high-school report cards. It will assess his various abilities well and give a good basis for guiding them. But though examinations need not be used frequently to determine the level of pupils' achievement, they should be used often for instructional purposes.

The examination may, for instance, serve an educational purpose. To fulfill this objective, it should be so devised and so used that it promotes the pupil's education. The teacher gives it not to coerce the student to work but with the understanding that no marks will be based on it and that it is intended to help the student discover his strength and weakness. We might call this approach the *diagnostic process*. The student will be guided in his studying by the results of the examination, and the teacher will help him with his particular difficulties. For this purpose, examination should be used frequently.

Finally, tests may be used to organize and integrate knowledge. They can be made more comprehensive in scope so that the student will have an opportunity to bring information from many fields to focus on a given problem. Generally, examinations are based on a part of a course; at the most, on a whole course. Instead, they should be devised to cover a large body of knowledge and thus to encourage the student to integrate his ideas and not isolate them from one another. Thus, the examination over the larger areas of learning should not be used merely to measure, like the term test which the student does not see again, but to help the student see the interrelationships of the various fields of knowledge and to help him strengthen himself where the examinations reveal that he is weak. The test thereby becomes a valuable part of the educative process.

#### SUMMARY

The examinations and tests used are the essay, the objective, and the standardized. The first requires the student to write

about a subject using sentences and paragraphs. Some of the disadvantages of this are as follows: It causes the student to be wordy and repetitious and to write extraneously. Furthermore, the questions may not cover all the material of the lessons; and also, when the teachers mark the examinations, they differ considerably in their valuations.

The essay examination, if carefully prepared and administered, will stimulate students to organize their material and express themselves logically; their study, too, will be more thorough and comprehensive.

The objective examination has the advantage of containing many items and, if carefully prepared, will cover the material studied more adequately. It is reliable also in that instructors will differ little in their scoring. The major disadvantage of the objective examination is its effect on the methods that students use to study and learn.

The recognition types of item are the true-false, multiple choice, matching, and classification items. The recall types are the completion and the recall items. Evidence indicates that the recall type causes more effective study and learning than the recognition items cause. For the latter, the students tend to become only fact getters and are not stimulated to organize and evaluate their facts.

The standardized achievement test has definite standards and norms, which enable the teacher to compare the achievement of her pupils in any subject with the average achievement of children of the various school ages and grades. By standard and norm, we refer to the average achievement of any given age and grade, and various factors are discussed that influence the achievement of the pupils and that should be taken into account when comparisons are made with the standards of any given achievement test.

E.A. refers to the average achievement of any given age in reading, geography, arithmetic, or other school subjects. A.Q. is found by dividing E.A. by M.A.

The theory of the A.Q. is very interesting, but its deficiencies lie in the unreliability of the educational and mental tests and in the fact that the younger, brighter children with the higher M.A.'s have been in school a relatively short time, whereas the older, dull children with the smaller M.A.'s have been in school several years more. There are other reasons also, but they are too complicated to set forth in this text.

The examination can be used as a means for coercing the students to study, for measuring their achievements in order to classify and mark them, and also for finding out the character of their achievement so that they can be taught more discriminately. The last point is probably the most important, because then the examination is used to teach the students in those areas where they are weakest.

### Problems and Exercises

1. What can the teacher do to avoid the usual weaknesses of the essay examination?

2. Which of the two examinations, the essay or the objective, do you prefer? Give your reasons.

3. If you cannot answer from experience, indicate from your reading the difference in the way in which students study for the essay and objective examinations.

4. Take, for purposes of illustration, a test with 150 items. Demonstrate by using the formula  $R - W$  that the difference between the highest and lowest scores is increased considerably over what the scores would be if they were determined by the number right.

5. Prepare an objective test on this or another chapter, using the different types of items illustrated.

6. Give your reactions to the advantages and disadvantages that have been noted for the objective test. What is meant by the statement that the tests may freeze the curriculum?

7. Define and illustrate the following terms: *standards, educational age, norms, geographical age, chronological age, reading age, achievement quotient, accomplishment quotient, and arithmetical age.*

8. Why is the very bright child in a grade likely to have an achievement age under his mental age?

9. Why is the dull child of a grade likely to have an A.A. above his M.A.?

10. A teacher says to her pupils, "The examination tomorrow will be used to discover what you know and what you do not know. After the papers have been marked, they will be returned to you; and the teaching will be based on what the tests reveal about the status of your knowledge." What use of the examinations does this illustrate?

11. Another teacher says, "You will be given an examination tomorrow, so you had better get down to work." What use of the examination does this illustrate?

12. A teacher says to her pupils that she is going to give the examination so that she will have a basis for marking them. What use of the examination does this illustrate?

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# APPENDIX

## DISCUSSION OF SOME STATISTICAL AND EXPERIMENTAL CONCEPTS THAT ARE CONTAINED IN THIS VOLUME<sup>1</sup>

### CORRELATION

One of the most common and probably one of the most important concepts in psychology and education is that of correlation. It appears many times in this volume, and it is highly desirable that the reader have more than the ability to recite a few words about it. Rather, he should have a true comprehension of it.

A synonym for correlation is *relationship*. In statistics, correlation pertains to the relationships between traits, scores, values, and other quantities. In the text, the relationship or correlation of school marks, of the characteristics of identical twins, and of many other values is given, and the amount of the correlation is indicated by a decimal fraction usually expressed in hundredths.

**Nature of Correlation.**—First let us consider the nature of correlation by using columns of values. When thinking of correlation, think of pairs of scores or values arranged in vertical columns. Each pair represents the scores or attributes of a person or thing. Examine the relationship between the values in Table A. The pairs of values are designated with Roman numerals. Note how the values are related. Observe pair I, with the values 24 and 60, the largest in each column; thus, the highest value is related or associated with the highest. Note also that in pair II, the next to the highest is related to the next to the highest; in pair III, the third from the highest in the column of X values is accompanied by

TABLE A

|      | X  | Y  |
|------|----|----|
| I    | 24 | 60 |
| II   | 22 | 55 |
| III  | 20 | 50 |
| IV   | 18 | 45 |
| V    | 16 | 40 |
| VI   | 14 | 35 |
| VII  | 12 | 30 |
| VIII | 10 | 25 |
| IX   | 8  | 20 |
| X    | 6  | 15 |
| XI   | 4  | 10 |
| XII  | 2  | 5  |

<sup>1</sup> For a fuller treatment of the topics discussed here as well as of other statistical topics, see the author's text *Statistics for Students of Psychology and Education* (McGraw-Hill) or any other standard text.

the third from the highest in the Y column; and so on down to the value 2, the smallest X value, accompanied by 5, the smallest Y value. These relationships make up a perfect positive correlation which is designated by the coefficient of correlation 1.00.

TABLE B

|      | X  | Y  |
|------|----|----|
| I    | 24 | 5  |
| II   | 22 | 10 |
| III  | 20 | 15 |
| IV   | 18 | 20 |
| V    | 16 | 25 |
| VI   | 14 | 30 |
| VII  | 12 | 35 |
| VIII | 10 | 40 |
| IX   | 8  | 45 |
| X    | 6  | 50 |
| XI   | 4  | 55 |
| XII  | 2  | 60 |

The correlation is said to be plus one.<sup>1</sup>

In Table B, the relationship of the pairs of values has been changed. Now the X and Y values are associated systematically in reverse order—the highest with the lowest; the next to the highest with the next to the lowest; and on down to the last pair, number XII, in which the lowest is associated with the highest. This relationship is called a *perfect negative correlation*, and it is designated by the coefficient of correlation  $-1.00$ . The correlation is said to be a negative one.

The order of the 12 pairs of values will be changed again, as shown in Table C. In this instance, no consistent relationship, either positive or negative, exists between them. The high, average, and low values are associated in a hit-or-miss fashion, so to speak. The correlation of the values as arranged in Table C is called a *zero correlation* and is expressed by the coefficient 0.00.

**Extent of Correlation.**—Correlations range in magnitude from zero to either plus or minus one and are usually expressed in hundredths although sometimes in thousandths.

In the text, various coefficients were given, some very high, as those in the .90's; others moderate, as those in the .40's and .50's. Low correlations are in the .10's and .20's. The examples given on these pages illustrate correlations of plus and minus one and of zero, or no correlation. There are intermediate amounts of correlation, in which the extent of relationship varies between the extremes illustrated. When the trend is greater, the coefficient expressing the relationship approaches plus or minus one; and when the relationships are least, the coefficients approach zero.

The nature of the correlation is indicated by whether it is positive or negative. If the trend in the magnitude of the values is inverse, then

<sup>1</sup> When correlations are positive, the sign is usually omitted.

TABLE C

|      | X  | Y  |
|------|----|----|
| I    | 24 | 10 |
| II   | 8  | 50 |
| III  | 14 | 60 |
| IV   | 2  | 20 |
| V    | 6  | 30 |
| VI   | 12 | 40 |
| VII  | 20 | 25 |
| VIII | 22 | 55 |
| IX   | 4  | 35 |
| X    | 18 | 45 |
| XI   | 16 | 5  |
| XII  | 10 | 15 |



the correlation is negative; and if it is direct, then the correlation is positive. The nature of the correlation, whether positive or negative, does not determine the extent of relationship. The relationship is measured only by the coefficient.

Thus, a coefficient of correlation of  $-.50$  indicates the same extent of relationship as does a correlation of  $+.50$ . The difference is in the nature of the relationship, as indicated by the Tables A and B and their accompanying discussions.

Coefficients of correlation range from zero to plus or minus one, as has been indicated; and questions may be raised as to the extent of relationship according to coefficients  $.10$ ,  $.20$ ,  $.30$ ,  $.40$ , etc. The answer to this question is very complicated and will be treated only in a general and superficial way. It is probably sufficient to say that the extent of correlation does not follow closely its numerical size. For example, a correlation of  $.80$ , roughly speaking, is considerably more than twice the correlation of  $.40$ ; and similarly with other correlations. In somewhat the same fashion, the difference between correlations of  $.90$  and  $.80$  is much greater than the difference between  $.20$  and  $.30$ , for example. In other words, differences in correlation nearer plus or minus one are much larger than similar numerical differences in the coefficients nearer zero. The differences are least important near zero and increase in importance with the size of the coefficient, being greatest near plus or minus  $1.00$  in the manner that has been indicated.

A direct consideration of some of the coefficients reported in the text will help to explain the size and meaning of coefficients of correlation. Table VII (page 224) contains correlations that range from  $.371$  to  $.981$ . None of the correlations is negative. The correlation of  $.981$  between the standing height of the pairs of identical twins indicates that their heights correspond almost perfectly. There were two measurements in this case for each pair of twins, which consisted of the height for each of two twins in a pair. If the twins had had exactly the same height, the correlation would have been  $1.00$ ; but because the coefficient is close to  $1.00$ , it is apparent that the height of the members of each pair was almost the same.

In the case of a correlation of  $.371$ , it is apparent that the scores on the Woodworth Mathews test of mental health for the members of each pair did not correspond very closely. Even though there was a trend in the similarity of the scores, there was considerable disagreement.

In the case of coefficients in the  $.70$ 's and  $.80$ 's, considerable similarity exists in the scores and measurements; and for coefficients in the  $.90$ 's, the correspondence is really high.

Correlation, then, refers to the relationship or correspondence of scores, values, or variables. The nature of the relationship is indicated

by the terms *positive* and *negative*. The extent of correlation, in turn, is indicated by the size of the coefficient of correlation.

### HETEROGENEITY AND HOMOGENEITY—MEASURES OF VARIABILITY

Statistically, the concepts of heterogeneity and homogeneity are quantitatively explained by measures of variability. The variation of groups is described by determining, for example, the range and standard deviation of a group. Other measures of variability are used, but it will suffice to describe these two briefly.

The range is the distance from the highest to the lowest. The range in the age of the pupils of a given class, for example, is found by subtracting the age of the youngest from the age of the oldest. If the youngest child in a sixth grade, for instance, is ten years three months and the oldest is sixteen years six months, the range in age is 6 years 3 months. The range in I.Q., M.A., A.A., height, weight, and other values is found in the same way. The range gives the teacher the distance between the extremes of a group for any characteristic and thus gives a general index to the heterogeneity or homogeneity of a group.

The standard deviation is a more valuable measure of variability than the range, being determined in a statistically sound manner by taking every score or value of a group into account. In a normal or fairly normal or symmetrical distribution, the standard deviation is the distance above and below the mean that includes about two-thirds of the scores or values.

In groups having approximately the same averages, the size of the standard deviation indicates the variability of the groups. Because the amount of variation in groups is so important educationally, a knowledge of the variability of groups, or classes, in a school might result in action for better adjustment of pupils to school situations as well as for changing the situations for the pupils.

### MEASURES OF CENTRAL TENDENCY

These have been mentioned and discussed either directly or indirectly to a sufficient extent. If a fuller knowledge and understanding of the averages or measures of central tendency as well as of other statistical measures are needed or desired, a text in statistics should be consulted.

### EXPERIMENTAL AND CONTROL GROUPS

In the course of experimentation, scientists have found it necessary to test their theories and hypotheses by arranging their experiments so as to make use of experimental and control groups. The need for having a "control" was strikingly demonstrated in William James's uncon-

trolled experiment in which he first memorized 158 lines of Hugo's *Satyr* in 131 minutes, then "practiced" his memory 20 minutes a day for 38 days on *Paradise Lost*, and then found that it took him 151½ minutes to memorize 158 other lines from Hugo's *Satyr*. He concluded that because it took him longer to memorize the second 158 lines, his mind had not improved. This experiment lacked a "control." According to good experimental procedure for a situation such as this one, it is necessary to have a single variable, which in this instance would have been the practice on *Paradise Lost*. It is possible that the second 158 lines of Hugo's *Satyr* were more difficult and therefore required more time to memorize, even though practice on *Paradise Lost* had increased efficiency. The experiment, in order to be valid, should have had an experimental and control group, as indicated by the following hypothetical example:

|                                                                      | Experimental group<br>(30 high-school juniors)                  | Control group<br>(30 high-school juniors) |
|----------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------|
| Initial test (memorizing 158 lines from <i>Satyr</i> ) . . . . .     | 181                                                             | 180 5                                     |
| Practice . . . . .                                                   | Memorizing <i>Paradise Lost</i> 20 minutes each day for 38 days | No practice in memorizing                 |
| Final test (memorizing 158 other lines from <i>Satyr</i> ) . . . . . | 178                                                             | 180                                       |

It is highly desirable that the initial abilities of the two groups be equal or very nearly so, which is true in this example. The experimental group is given special practice, the value of which is being tested. In this instance, the plan of the experiment is to test the value of practice in memorizing *Paradise Lost* on the ability to memorize lines from the *Satyr*. The control group had not had any practice in memorizing, and it is assumed that the experiences that might affect the results are the same for both groups except for the special practice of the experimental group. This, being the only difference, is known as the *single variable*; and if there is any difference in the results, it can be attributed to this one difference in their experience.

According to this hypothetical arrangement, the score (number of minutes) of the experimental group is slightly better than the control, thus hypothetically indicating that probably a little advantage accrues from the practice on *Paradise Lost*. The difference, however, should be tested statistically to see if it is large enough to be statistically significant.

The outline given here is simple. For instance, other experimental groups could memorize nonsense syllables, mathematical formulas,

Latin words, or any other material. It is necessary, however, to have a control group not experiencing the activities that are the variables whose effects are being tested.

### SIGNIFICANCE OF THE DIFFERENCE

This term is frequently used in psychology and education, and its general meaning should be set forth. Its fuller meaning will have to be obtained by special study and instruction. When the difference between the averages of two groups is found, the question is asked: Is the difference large enough to be significant? In other words, it may be asked whether or not similar differences will be found if corresponding groups are compared under similar conditions a great number of times. If, with repetition, a difference was found between groups, and the same group was superior each time, then we may be sure that the difference is a true and significant one.

Obviously, it is impossible to repeat an experiment a large enough number of times to discover whether one group or the groups of the same characteristics are always superior and thus to determine that the difference first obtained is a true one. For example, if one is testing the effectiveness of a method of teaching reading by comparing it with other methods through actually trying the various methods on groups of pupils of similar initial ability and capacity, it would be impossible to repeat the experiment indefinitely to see if the differences obtained are consistent and thereby real ones. Instead, statistical procedures are applied to the averages of the groups to determine whether the differences are true ones or are due to chance or to factors incident to a poorly managed and controlled experiment. The results of the statistical analysis also indicate the extent to which the differences are real ones and thus indicate the certainty with which we can conclude that a difference will occur under similar circumstances.

In other words, the largeness of the difference is tested. Thus, when it is said that the difference between two groups, as determined by comparing their averages, is significant, it means that the difference has been tested and found to be a real one and not one due to chance or accidental and extraneous factors. Then reliance can be placed on the value of the method, influence, or factor being tested.

## GLOSSARY<sup>1</sup>

- Aberration, mental.** Deviation from the average, or normal, in mode of thinking and behaving to a degree sufficient to be considered a disorder.
- Accomplishment quotient.** Obtained by dividing the achievement age by the mental age. Achievement age is determined for any given subject by means of standardized tests in that subject; and mental age by means of an intelligence, or mental, test.
- Adolescence.** The period between childhood and maturity; it approximates the teens.
- Adrenals.** Ductless glands adjacent to the kidneys. The adrenals give off a chemical known as *adrenalin*, which releases a sugar supply from the liver for energy purposes.
- Alpha hypothesis of learning.** One of Dunlap's principles of learning: A response to a stimulus increases the likelihood of that response's resulting from the same stimulus.
- Analogies.** In psychology, the relationship of pairs of attributes or qualities as found in mental, or intelligence, tests.
- Antisocial.** Refers to behavior that is not for the good of society.
- Associated response.** A response to a different stimulus from the one that ordinarily produces the response because the stimulus was paired with the usual stimulus.
- Age, chronological.** The number of years, months, and days that one has lived.
- Age, mental.** Mental level according to the average scores of any given age as determined by mental, or intelligence, tests.
- Age, subject matter.** Educational age, level of achievement in standardized, subject-matter test according to the average scores of any given age. Arithmetic, history, reading, geography, and other subject-matter ages are determined by the average obtained by pupils of any given age on standardized test for each subject.
- Beta hypothesis of learning.** One of Dunlap's principles of learning: The response to a stimulus lessens the probability of that response to the same stimulus.
- Caffeine.** An alkaloid that has a stimulating effect and is usually associated with coffee and tea.

<sup>1</sup> These definitions and descriptions apply especially to psychology and education.

- Compensation.** Behavior that has for its purpose the making up for or the covering over of weakness and deficiency. Frequently, the compensating behavior is undesirable.
- Complex.** An emotionally colored idea. Hate, bias, prejudices, and jealousies are complexes.
- Concave learning curve.** The curve, or portion of a curve, that is concave because it represents increasing rate of learning.
- Conditioned response.** A response brought out by one of two stimuli occurring together when the other stimulus first evoked the response.
- Configuration.** The pattern, form, or structure of stimuli resulting from their relationships or arrangement.
- Conflict.** The clash or struggle of conflicting ideas, ideals, and tendencies of behavior.
- Congenital.** Acquired or influenced during the period of gestation, or in the uterus.
- Convex learning curve.** A curve, or portion of a curve, in which the rate of learning is decreasing.
- Correlation.** The relationship between traits, qualities, or measurements. The coefficient of correlation is a numerical amount ranging from  $-1.00$  to  $+1.00$  which indicates the nature of the relationship or correspondence and also its extent.
- Cretin.** An infant or child who is suffering from a deficiency of the secretion given off by the thyroid gland. A cretin's physical development is not normal, and he is mentally deficient.
- Critical ratio.** A statistical quantity calculated to determine whether or not the difference between two quantities is statistically significant or due to chance factors.
- Daydreaming.** Refers to the act of withdrawing into the imaginative world, or realm of fancy—usually to provide a more pleasant world than the real one.
- Defence mechanism.** Refers to psychological processes practiced by those making poor adjustments in order to protect themselves from the forces and stimuli of life. Negativism and rationalization are examples of defence reactions.
- Delinquent.** A boy or girl whose behavior is antisocial.
- Development.** Change in character and quality accompanying growth. In psychology, most emphasis is placed on physical, mental, social, and emotional development.
- Deviate.** One who differs considerably from the normal, or average. Either a feeble-minded person or one of exceptional talents may be classified as a deviate.
- Differential retention.** Degrees of retention for different types of material; some is forgotten more rapidly than others.

- Discrete.** Entirely separate and distinct. The opposite of *continuous*.
- Disuse, the principle of.** According to this principle, facts, knowledge, information, and skills that are not reviewed, practiced, or used are forgotten.
- Ductless glands.** Glands that give off their chemical or hormone directly into the blood stream. The thyroid, adrenals, pituitary, and others are ductless glands and make up the endocrine system.
- Educational age.** Same as subject-matter age.
- Effect, principle of.** A principle of learning: If the result is pleasant, the response to a stimulus is strengthened, but it is weakened if the result is not satisfying or is unpleasant.
- Emotion.** A state of strong feeling. Emotion is accompanied by physiological reactions. Some of the more common emotions are joy, anger, fear, and grief.
- Emotional adjustment.** Effective control of the emotions and good emotional responses to the situations of life.
- Endocrine glands.** The ductless glands, such as the thyroid, adrenals, and pituitary, whose secretions pass directly into the lymph or blood.
- Enuresis.** Inability to control adequately the passage of urine.
- Escape mechanism.** A term used in connection with mental health or mental hygiene. It refers to methods of escaping from reality by means of daydreaming, phantasy, and repressions.
- Exercise, principle of.** A principle of learning involving use and disuse: That which is used and practiced is learned, but that which is not used and practiced is forgotten.
- Extrovert.** A person whose thoughts, energy, and behavior are directed to persons and things away from self. The opposite of *introvert*.
- Feeling.** Same as *emotion*, except that feeling is not so strong or intense.
- Fontanelle.** Soft spot, or opening, on the top of a baby's head. It usually closes at the age of about 18 months.
- Free association.** Refers to the process of responding to a given word with the first word that comes to mind.
- Gamma hypothesis of learning.** One of Dunlap's principles of learning: A response to a stimulus does not influence the probability of that response's being evoked again by the same stimulus.
- Generalization.** The conceptional process of applying knowledge and principles acquired in one situation to another. The principle of generalization is employed to explain transfer of training.
- Gestalt.** The German school of psychology. Stress is laid on the organization, pattern, or configuration of the stimuli and response.
- Granular.** Refers to the middle layer of the cerebral cortex through which sensory impressions are conveyed.

**Heterogeneous.** Refers to classes or groups the members of which vary considerably in their characteristics. The opposite of *homogeneous*.

**Heterozygous.** Refers to germ cells that have heterogeneous determiners for various qualities.

**Hierarchical.** Pertaining to the organization of skills, habits, and concepts at levels ranging from the simple to the complex.

**Homogeneous.** Refers to classes or groups the members of which vary comparatively little in their characteristics. The opposite of *heterogeneous*.

**Homozygous.** Refers to germ cells that have like determiners for various qualities.

**Hormone.** A chemical secretion given off by the ductless, or endocrine, glands.

**Hyperthyroidism.** A physiological condition involving the overactivity of the thyroid gland.

**Hypothyroidism.** A physiological condition involving the underactivity of the thyroid gland.

**Identical elements, transfer according to.** According to this theory, transfer takes place to the extent that the elements in two situations are identical.

**Inferiority complex.** Thoughts of self are accompanied by feelings of inferiority. A person with an inferiority complex is often shy and lacks confidence in himself.

**Infragranular.** The inner layer of the cortex. It is most developed at birth—about 82 per cent—and is functionally involved with the reflexes and instinctive responses.

**Insulin.** A chemical from the islands of Langerhans in the pancreas. Insulin promotes the utilization of sugar. It is also manufactured from the pancreas of sheep and oxen and used by diabetics.

**Intelligence quotient.** Obtained by dividing mental age by chronological age. It is the index of brightness and indicates the rate of mental growth. Mental ratio.

**Internal secretion.** The secretion, or chemical, given off by the ductless, or endocrine, glands.

**Introspection.** The mental process of looking into and examining one's own thoughts, feelings, and activities. Looking into one's own mind.

**Introvert.** A person whose thoughts and feelings are directed inward to himself. The opposite of *extrovert*.

**Langerhans, islands of.** The part of the pancreas that gives off insulin.

**Maladjustment.** Poor and ineffective reactions to the situations of life. Unsatisfactory behavior; a state of poor mental health. Not in harmony with the environment.



**Malnutrition.** Poor nutritional status.

**Maze.** Devices, instruments, or figures containing many pathways, or routes, and varying in complexity. The object is to find the most direct route from the beginning of the maze to the end. Mazes are used to test the abilities of both human beings and animals.

**Mean.** A measure of central tendency determined directly by dividing the sum of the scores or values by their number.

**Median.** A measure of central tendency. The median is the value above and below which there is an equal number of values when they have been arranged according to size.

**Medullary sheath.** The nerve fiber (axon, or dendrite) is surrounded by a fatty covering which, in turn, is encased by an outside covering, or membrane, known as the *neurolemma*. A fiber so enclosed is said to be *medullated*; the medullary sheath consists of the *neurolemma* and the fatty sheath.

**Mental age.** Determined by the use of mental, or intelligence, tests. The average score for children of any chronological age. Indicates the mental age of any who obtains that score. Mental age indicates mental level, or level of mental development.

**Mental discipline.** Training or disciplining the mind through the processes of study and intellectual activity. The qualities purported to be obtained thereby are also purported as manifesting themselves in any situation in which the mind is used.

**Metabolism.** The building up and breaking down of living matter. Utilization of food by the body.

**Mode.** A measure of central tendency. It is the most common characteristic or the most frequent score or value.

**Myxedema.** Hypothyroidism in an adult.

**Negativism.** A mode of behavior in which a person tries to adjust to a situation by not responding or by doing the opposite of that which is suggested or required by the situation.

**Neurological development.** The development of the nervous system.

**Nonsense syllable.** A syllable that is not a word or a part of a word and has no established meaning.

**Normal distribution.** A symmetrical distribution that has definitely established statistical values. In a normal distribution, one standard deviation above and below the mean includes 68.26 per cent of the scores or cases.

**Norms.** Standards or averages.

**Overprotection.** A solicitude for the welfare of a person that is so extreme that he is shielded from too many of the forces and activities of life. Parents who overprotect their children and shield them so much that the latter do not learn to cope with their environment.

- Objective.** Free from bias or prejudice. When used with tests, it refers to those scored with key or machine, so that the personal element of the scorer is entirely removed.
- Oedipus complex.** A complex in which the attachment of children for their parents of opposite sex is abnormally strong.
- Optimum.** The most favorable degree, amount, or condition.
- Ovaries.** The female reproductive organ in which the eggs are produced.
- Overlearning.** Learning beyond the point where the material is just learned. Thus, if a child can just barely recite an arithmetic table, overlearning consists of learning the table more thoroughly by spending more time on it.
- Ovum.** The female germ cell.
- Percentile.** A score, or value, that has a definite position in a distribution on the basis of percentages. Thus, a value that is the seventy-fifth percentile has 75 per cent of the values below it and 25 per cent above.
- Phantasy.** Daydreaming, an imaginary world.
- Physiological limit.** The point at which performance cannot be exceeded because of the limit of the capacity of eyes, fingers, legs, or any other part of the body. Thus, the rate that the eyes move sets a limit on the speed of reading, and the rate with which the fingers move sets a limit on the speed of typewriting.
- Pineal.** A small ductless gland in the brain whose function is not clearly understood.
- Pituitary.** A ductless gland in the brain whose secretion influences growth.
- Plateau.** That part of the learning curve which is flat and thus represents the period of no apparent progress.
- Plus gestures.** Certain types of behavior by a person that are designed to set him off favorably in the eyes of others. Plus gestures are a substitute for a successful adjustment in life.
- Pollyanna, sweet lemon.** An attitude or response to the effect that "everything is for the best" and it could have been worse, so therefore we should be pleased.
- Power.** Refers to the power of the mind as determined by the complexity or difficulty of tasks that can be mastered when plenty of time is given; the factor of speed is minimized when power is tested.
- Practical limit.** The achievement reached by moderately strong but not extreme effort.
- Projection.** Attributing to others the weaknesses that are characteristic of oneself.
- Psychosis.** Insanity, mental disease. Much more serious than the conditions described in this book under mental health and mental hygiene.

**Quotient, intelligence.** Mental age divided by chronological age.

**Quotient, accomplishment.** Achievement age, such as reading age and geography age, divided by mental age.

**Quotient, achievement or educational.** Achievement age divided by chronological age.

**Rationalization.** The process of giving logical and reasonable but untrue excuses. The reasons given are not true to the motives. The purpose is to deceive self and others in order to maintain a better status in the eyes of oneself and others.

**Regression.** Tendency to move toward the average.

**Reliability.** The accuracy of a test or measuring instrument. Consequently, a reliable instrument gives the same results on any occasion under the same conditions.

**Repression.** Holding back, or "pushing into the subconscious," certain feelings and ideas. One who "bottles up," or keeps secret, many of his experiences, emotions, and ideas is said to repress them.

**Retention, memory.** The opposite of *forgetting*.

**Sample, sampling.** A part of the total that is representative of the total. A portion that has the characteristics of the whole. When it is impossible to study all the children, for example, a number of them, or a sample, is selected carefully so that it will represent as closely as possible the total group.

**Sensorimotor.** Refers to response, or behavior, involving the senses, nerves, and parts of the body, such as the fingers, arms, and legs.

**Sour grapes.** A form of rationalization in which the person who fails to obtain his objectives states that they were not worth achieving anyway. The grapes, which represented the objective and were not obtained, are said to be "sour."

**Speed.** The number of tasks of uniform but not very great difficulty that can be done in a fixed period determines speed of performance and is interpreted as indicating mental ability. Should be contrasted with *power*, which refers to the difficulty of the task that can be accomplished when plenty of time is allowed.

**Sperm.** The male germ cell.

**Standard deviation.** A measure of variability; the distance above and below the mean that includes 68.24 per cent of the cases or scores.

**Standardized test.** A test for which norms, or standards, have been established. It has been used to determine the exact performance for persons of given ages and in some cases for a given grade.

**Superiority complex.** A complex descriptive of a person whose feelings of self are of being superior to others. Such a complex in a desirable form is equivalent to healthy confidence; but in its unhealthful form, it represents compensation for inferiority.

**Supragranular.** The outer layer of the cortex, least developed at birth. It probably continues to develop longest of all the layers. It is involved in the higher mental processes.

**Temper-tantrum.** A fit of temper indulged in to obtain one's way. Children often throw themselves on the floor and kick, scream, and hold their breath in order to get what they want.

**Thymus.** A gland located in the lower part of the throat. It reaches its highest development at about the age of fifteen and gradually atrophies after that age. Its function is not satisfactorily understood.

**Thyroid.** A very important ductless gland located in the neck close to the larynx.

**Thyroxin.** The secretion given off by the thyroid. A deficiency or excess of this chemical seriously affects health and personality.

**Transfer.** Learning through recognition, use, and application of knowledge, skills, and habits in a given situation that were learned in another.

**Unreliability.** Not possessing reliability. See *Reliability*.

**Use, principle of.** A principle of learning: knowledge and skills that are used are strengthened and retained. Correspondingly, the retention of that which is not used is weakened.

**Validity.** Term used with reference to tests and measurements to the effect that tests have validity if they measure what they are intended to measure. Thus, an intelligence test has validity if it measures true intelligence and not schooling and other advantages.

**Variability.** The range, spread, and heterogeneity of scores, values, and characteristics. Variability is described by a number of statistical quantities.

**Viscera.** The internal organs in the cavity of the body, such as the stomach, heart, intestines, and liver. They are very important emotionally.

**Worry.** Overconcern and care about the past, the present, or the future. Concern that is fretful and troublesome.

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